The Connecticut River Strategic Plan

VOLUME ONE

PREPARED BY
Pioneer Valley Planning Commission

IN COOPERATION WITH
Connecticut River Watershed Council
Connecticut River Watershed Team
Franklin Regional Council of Governments
Massachusetts Water Watch Partnership
University of Massachusetts Extension

PREPARED FOR
Massachusetts Executive Office of Environmental Affairs

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The Connecticut River Strategic Plan

Massachusetts Watershed Initiative

Volume I

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The ***Connecticut River Strategic Plan*** was guided by the involvement of hundreds of residents who participated in workshops and public surveys throughout the planning process. A Watershed Survey was completed in 1999 of civic leaders in all Massachusetts communities in the Connecticut River mainstem water shed to establish the top priority problems and goals for the watershed. A large watershed-wide public forum was held in Hadley, Massachusetts in November, 1998 to identify priority problems and to brainstorm possible solutions. Ideas from this public involvement were organized and refined in this report by the following organizations and staff:

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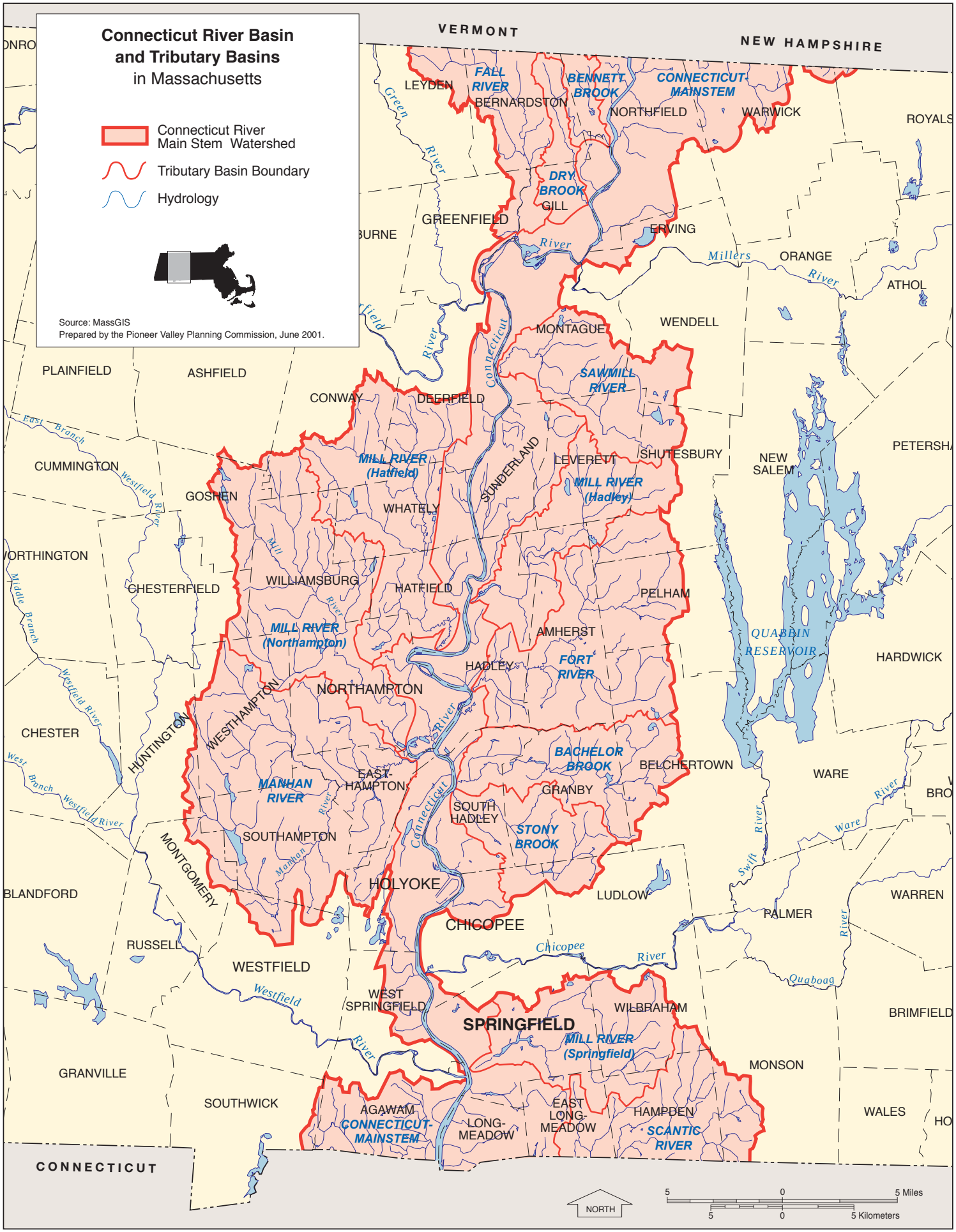
Connecticut River Basin
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Connecticut River
Main Stem Watershed
Tributary Basin Boundary
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Source: MassGIS
Prepared by the Pioneer Valley Planning Commission, June 2001.
VERMONT
NEW HAMPSHIRE
CONNECTICUT
FALL RIVER
BENNETT BROOK
CONNECTICUT MAINSTEM
DRY BROOK
SAWMILL RIVER
MILL RIVER (Hatfield)
MILL RIVER (Hadley)
MILL RIVER (Northampton)
FORT RIVER
BACHELOR BROOK
MANHAN RIVER
STONY BROOK
MILL RIVER (Springfield)
CONNECTICUT-MAINSTEM
SCANTIC RIVER
QUABBIN RESERVOIR
LEYDEN
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NORTHFIELD
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SHUTESBURY
NEW SALEM
CUMMINGTON
GOSHEN
WHATELY
WILLIAMSBURG
HATFIELD
PELHAM
AMHERST
HADLEY
NORTHAMPTON
CHESTERFIELD
CHESTER
HUNTINGTON
WESTHAMPTON
EAST-HAMPTON
SOUTH HADLEY
GRANBY
BELCHERTOWN
WARE
HARDWICK
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MONTGOMERY
HOLYOKE
LUDLOW
CHICOPEE
PALMER
WARREN
BLANDFORD
RUSSELL
WESTFIELD
WEST SPRINGFIELD
SPRINGFIELD
WILBRAHAM
MONSON
BRIMFIELD
GRANVILLE
SOUTHWICK
AGAWAM
LONG-MEADOW
EAST LONG-MEADOW
HAMPDEN
WALES
Green River
Millers River
Connecticut River
Westfield River
East Branch
Middle Branch
West Branch
Mill River
Manhan River
Swift River
Ware River
Chicopee River
Quaboag River
NORTH
5 0 5 Miles
5 0 5 Kilometers

EXECUTIVE SUMMARY

1. INTRODUCTION

This Connecticut River Strategic Plan (CRISP) identifies stakeholder goals and issues, describes existing resource conditions and issues, identifies future management strategies to achieve an integrated watershed management system, and reports on a number of demonstration subwatershed projects.

The document consists of two volumes, in addition to the Executive Summary. Volume I is a detailed Strategic Plan for the Connecticut River Watershed in Massachusetts. The plan is organized into the following watershed management issues: water quality and quantity; preservation of streams and wildlife habitat; land use, growth management and economic development; public access, recreation and greenways; and coordination and watershed management partnerships. Within each issue category there are goals, an assessment of the current situation, strategies, and specific recommended actions, which are summarized below.

2. WATER QUALITY AND QUANTITY

PRIORITY ISSUES

The top three water quality goals, identified by civic leaders, for the Connecticut River are:

1) **improve water quality within the Connecticut River and its tributaries;**
2) **increase state and federal funding for water quality, and;**
3) **bring all segments up to Class B ("fishable and swimable") water quality.**

The top three water quality problems identified by civic leaders are:

1) **stormwater runoff from developed areas;**
2) **combined sewer overflows, and;**
3) **riverbank erosion and sedimentation.**

Assessment of Current Situation

Water quality in the Connecticut River has improved dramatically in the 28 years since the passage of the Clean Water Act of 1972, and each of the 23 communities on the Massachusetts reach of the Connecticut River now has at least secondary wastewater treatment. However, as of 1995, the Massachusetts Department of Environmental Protection noted that the water quality in the entire length of the Connecticut River main stem in Massachusetts was not meeting its designated Class B water quality standards. The entire river was not meeting DEP's standards for priority organics, particularly PCBs, and the southern reach of the river from Holyoke to Agawam was also impacted by pathogens and suspended solids from combined sewer overflows (CSOs).

In 1997, the New England Interstate Water Pollution Control Commission (The Health of the Watershed, NEIWPCC, January 1997) noted that the key water quality issues on the Connecticut River in Massachusetts are: CSOs in the segment below the Holyoke Dam; PCBs in fish in the entire length of the river; coal tar in the river in Holyoke; and flow regulation and fish passage above the Turners Falls Dam.

The Massachusetts Water Watch Partnership (MWWP) led a volunteer water quality monitoring project (the "Swimming Hole Project") in 1998, to test 12 sites on the Massachusetts portion of the Connecticut River for fecal coliform bacteria, an indicator of possible pathogenic health risks from water contact. The major findings were that: water quality appears to be worse

on wet days than on dry days; and during dry weather, the river generally appears to be clean enough to support swimming, fishing, boating, and similar recreational uses.

The tributary streams to the Connecticut River in Massachusetts are generally in better condition than the river's main stem. Most tributaries support their designated uses (i.e. are clean enough for fishing and swimming), although most are also threatened by one or more pollution source. Weston Brook and Lampson Brook in Belchertown only partially support their designated uses.

Strategies and Recommended Actions - Water Quality

Strategy #1 (Water Quality): Adopt a comprehensive CSO control program.

- seek Congressional action to continue and increase funding appropriations in the federal budget for Connecticut River CSO cleanup;
- encourage municipalities to apply for more low-interest SRF loans for CSO projects;
- seek EPA support for Connecticut River CSO Clean-up Initiatives under American Heritage Rivers designation;
- develop state enabling legislation for stormwater utilities, to create significant new revenue stream to fund CSO clean up needs.

Strategy #2 (Water Quality): Develop a consistent water quality monitoring program.

- set up a multi-organization consortium to establish an ongoing regional water quality sampling and monitoring program;
- encourage DEP and volunteer monitors to work together to establish a cooperative, ongoing river sampling program in the Connecticut River and its tributaries.

Strategy #3 (Water Quality): Reduce urban, suburban runoff, and rural non-point source pollution.

- implement improved street sweeping programs in every community to reduce pollutants in stormwater;
- identify demonstration sites for innovative stormwater best management practices;
- pass local stormwater ordinances/bylaws that require all developments to comply with the DEP stormwater standards;
- reduce pollutants in agricultural runoff.

Strategy #4 (Water Quality): Reduce soil erosion and sedimentation throughout the watershed.

- Identify and map severe erosion sites in the watershed.
- Assist communities with the adoption of erosion and sediment control bylaws.
- Encourage streambank restoration projects.

Strategy #5 (Water Quality): Reduce toxins in fish tissue.

- Undertake a program of PCB investigation and remediation.
- Increase public awareness of public health fish advisories by posting advisories in fishing and recreation areas.

Strategy #6 (Water Quality): Promote water conservation and efficient water supply delivery systems.

- Promote water conservation efforts in local communities.

Strategy #7 (Water Quality): Protect watershed and aquifer recharge lands to prevent it from being developed or contaminated.

- Provide technical assistance to water suppliers in efforts to acquire watershed or aquifer recharge lands.
- Minimize herbicide spraying along highways, utility corridors, and other right-of-way, especially within 100 feet of wetlands, rivers, and other surface waters.

3. PRESERVATION OF STREAMS AND WILDLIFE HABITAT

PRIORITY ISSUES

The top three goals for stream and wildlife habitat preservation for the Connecticut River are:

1) **increase public recognition and protection of important wildlife habitat in river areas;**
2) **identify and safeguard terrestrial and aquatic wildlife habitats, and;**
3) **preserve and restore vegetated riparian buffers.**

The top three problems related to preservation of streams and wildlife habitat identified by civic leaders are:

1) **loss of riparian buffer areas and wildlife habitat along streams;**
2) **introduction of non-native, invasive species to riverine areas, and;**
3) **physical barriers (dams, culverts, bridges, and other structures) block river connectivity.**

Assessment of Current Situation

A number of human activities have resulted in the direct loss or degradation of riverine habitats in the Connecticut River watershed. These include:

- the disruption of normal hydrology, such as the construction of dams and parking lots;
- degradation of water quality;
- erosion and sedimentation;
- riprap and other "hard" structure erosion control measures;
- stream channelization;
- extensive piping, or culverting, of streams through developed areas;
- introduction of invasive species;
- land use changes resulting in the loss or degradation of riparian areas; and
- withdrawal of water for drinking water supplies, irrigation or other consumptive uses.

Land use has had a major impact on the Connecticut River watershed, and particularly riparian areas. Impervious surfaces, stormwater discharges, soil disturbance, and road and highway maintenance are just some examples of how land use has affected stream hydrology, water quality, erosion, and sedimentation.

Invasive species, including plants (such as Water Chestnut, Japanese Knotweed, Phragmites, Fanwort, and Purple Loosestrife) and animals (Hemlock Woolly Adelgid), are serious concerns throughout the watershed.

Dams are impenetrable barriers to upstream and downstream fish passage, and prevent access for anadromous fish species, such as Atlantic salmon and shad, to their historic spawning areas. There are 46 dams on the Connecticut River or tributary streams in Massachusetts. Only three of these dams have operating upstream fish passage facilities in place (Holyoke, Turners Falls and Mitteneague Dams), and one dam has a fish passage facility planned (Northampton Street Dam on Manhan River). Other physical barriers to river connectivity present, but not yet inventoried in the Connecticut River watershed include:

- road and railroad crossings and culverts;
- channelized stream corridors and piped streams, and;
- highway and livestock fencing.

Strategies and Recommended Actions – Stream Preservation

Strategy #8 (Stream Preservation) Encourage and support the establishment of Stream Teams on tributaries and the mainstem of the river.

- Organize stream teams, where necessary, through outreach efforts, meetings, and training sessions.
- Support existing subwatershed organizations by providing technical assistance.

Strategy #9 (Stream Preservation): Ensure adequate fish passage in the mainstem and subwatershed branches of the river.

- Advocate, through the hydroelectric relicensing process, for all facilities to operate on a "run of the river" basis.
- Continue to support the return of Atlantic Salmon to the Connecticut River;
- Support and work to ensure that both upstream and downstream fish passage is installed at non-licensed dams and or river obstructions.

Strategy #10 (Stream Preservation): Prevent the introduction or spread of non-native, invasive species, especially nuisance aquatic species.

- Support agency and non-governmental organizations that are working to educate the public about the spread of exotics.
- When possible, prevent the spread of existing invasive species.

Strategy #11 (Stream Preservation): Reduce the impact of water withdrawals downstream of public reservoirs and withdrawal points.

- Make modifications to the timing and rates of public water supply pumping to reduce impacts on stream flows and water levels.
- Establish ecologically-based streamflow requirements.

Strategy #12 (Stream Preservation): Restore vegetated riparian buffers.

- Map priority areas for protection or restoration of vegetated riparian buffers.
- Preserve, protect, and improve vegetated riparian buffers.

Strategy #13 (Stream Preservation): Restore river connectivity.

- Develop strategies for the removal of barriers to river connectivity.
- Upgrade driveway, road, highway, and railroad stream crossings to promote greater fish and wildlife passage.

4. LAND USE, GROWTH TRENDS, AND ECONOMIC DEVELOPMENT

PRIORITY ISSUES

The top three goals for achieving sustainable land use, growth and economic development for the Connecticut River are (ranked in order of priority):

1) **encourage good development practices that do not adversely affect water quality, wildlife habitat and stream functions;**
2) **assist communities to protect open space (e.g. open space planning, zoning guidelines), and;**
3) **complete Master Plans and revise zoning regulations.**

The top three land use, growth and economic development problems identified by civic leaders are as follows (ranked in order of priority):

1) **loss of farmland and forestland to development;**
2) **environmental impacts from poor development practices, such as stormwater runoff, and;**
3) **low density urban sprawl and its impacts on community character, open space and water quality.**

Assessment of Current Situation

Low-density urban sprawl has become the Pioneer Valley's dominant form of growth. Within the lifetime of many current residents, 34,000 acres of land in the Pioneer Valley region have been developed for urban uses, a 71% increase (from 1952 to 1985). The development of land for urban uses is accelerating in the Pioneer Valley Region (Hampshire and Hampden County). In the fourteen years between 1971-1985, a total of 15,542 acres of open land was converted to urban use in the region, a rate of 1,110 acres per year. PVPC estimates that in the nine years between 1986-95, a total of 13,430 acres of land was developed, a rate of 1,492 acres per year.

Farmland and open space have experienced significant declines as a result of sprawl. The Connecticut River valley is listed as one of the twenty "most endangered agricultural regions in the United States" by the American Farmland Trust. Between 1971 and 1985 the region lost more than two thousand acres of intensively cultivated land. At the same time, close to sixteen thousand acres of non-farm open space was also developed between 1971 and 1985.

Tourism is the second largest industry in Massachusetts, and there is tremendous opportunity in the Connecticut River watershed for tourism expansion. Economic development strategies should capitalize on the region's amenities, such as the natural resources, to expand tourism within the watershed. Tourism can be a relatively low-impact activity that can encourage the preservation and restoration of the historic, cultural, and environmental resources within the region.

Strategies and Recommended Actions – Land Use

Strategy #14 (Land Use): Promote "Smart Growth" in the watershed.
- Identify the Connecticut River as a model or pilot for a Smart Growth initiative.
- Promote compact growth in and around existing urban centers.

Strategy #15 (Land Use): Preserve the rural character of the watershed by planning development based on an understanding of town's natural resources.
- Create watershed-based open space plans.
- Work with towns to develop or update open space plans.

Strategy #16 (Land Use): Improve stormwater management in watershed communities.
- Assist community boards with the review and regulation of development to improve stormwater management.
- Minimize development impacts through better site design.

Strategy #17 (Land Use): Identify and protect valuable open space in the watershed.
- Secure federal TEA-21 Enhancement grants and state transportation bond funds to acquire farmland (APRs) to help preserve rural character..
- Encourage communities to adopt the provisions of the Community Preservation Act.

Strategy #18 (Land Use): Promote and facilitate Brownfields redevelopment.
- Create an inventory of brownfields sites in the region that may offer opportunities for redevelopment.
- Develop a model for a regional brownfield industrial park.

Strategy #19 (Land Use, Economic Development): Promote environmentally sustainable economic development, such as tourism and agriculture.
- Seek designation of a National Heritage Corridor for the Connecticut River corridor.
- Promote agricultural tourism within the establishment of the Connecticut River Scenic Farm Byway.
- Support increased funding for the APR program.

Strategy #20 (Land Use, Economic Development):

Identify a location and process for developing an "eco-industrial" park.

5. PUBLIC ACCESS, RECREATION AND GREENWAYS

PRIORITY ISSUES

The top three goals for public access, recreation and greenways for the Connecticut River are:

1) **create connected greenways and trails;**
2) **expand the purchase of development rights to protect farmland and open space, and;**
3) **clean up and improve the visual aesthetics of the riverbank.**

The top three problems related to public access, recreation and greenways identified by civic leaders are:

1) **lack of connected greenways of protected open space and wildlife corridors;**
2) **lack of public access facilities, such as public lands, bikeways and walking paths along the river, and;**
3) **over-use of some river sections for water-based recreation.**

Assessment of Current Situation

Recreational use of the upper Connecticut River has increased in tandem with improvements in water quality since 1972. With the exception of organics, water quality in the Massachusetts section north of the Holyoke dam now meets Class B water quality standards, and is increasingly used for water-based recreational pursuits, such as power boating, kayaking, canoeing, swimming and fishing. Sections of the northern reach are over 100% of the estimated carrying capacity and are thus significantly overused. Currently, however, recreational use of the reach below the Holyoke Dam is limited primarily to power boating and fishing due to the presence of combined sewer overflows (CSOs) that convey raw sewage and stormwater into the river, thereby elevating bacterial counts to unsafe levels. Recreational opportunities to use the river will be enhanced by improving the water quality of the river below the Holyoke Dam.

The lack of adequate public access in the urban stretches of the river has been identified as a critical issue. There are several projects in the engineering or construction phase of implementation that are anticipated to stimulate demand for river use in the southern, urban segment of the river, for example, the Connecticut River Walk and Bikeway. Various governmental agencies could play a role in the establishment of a watershed-wide greenways network, either through providing management, technical assistance in acquisition, or funding opportunities.

Strategies and Recommended Actions – Public Access

Strategy #21 (Public Access): Continue and Support the Establishment of a Network of Greenway Corridors
- Develop a regional network of greenways along the Connecticut River and its tributaries.

Strategy #22 (Public Access): Use the river as a tourism destination point and an agricultural economic development tool.
- Support the completion of design and construction plans for the Connecticut River Walk and Bikeway and the development of the Franklin County Bikeway.

Strategy #23 (Public Access): Enhance the visual aesthetic of the Connecticut River in urban areas.
- Organize annual trash clean-up days.

Strategy #24 (Public Access): Balance increased water related activities and interests with environmental concerns.
- Identify and evaluate options to reduce the adverse impacts of over-use of the river.
- Work with the Public Access Board to develop additional public access sites, particularly for universal access.

6. COORDINATION AND WATERSHED MANAGMENT PARTNERSHIP

This section identifies key Connecticut River watershed stakeholders, including communities, regional agencies or non-profits, state and federal agencies, private sector groups, educational organizations, subwatershed organizations and others.

Strategy #25 (Coordination): Integrate the five-year cycles, work and plans of the five major tributary basins – Farmington, Westfield, Deerfield, Millers, Chicopee – and the Connecticut River.

Strategy #26 (Coordination): Develop a River Corridor Management Plan with the 19 riverfront towns long the main stem of the Connecticut River and the riverfront towns along the Farmington, Westfield, Deerfield, Millers and Chicopee Rivers.

Section 6 also contains brief summaries of the many plans, programs, and projects (past and present), addressing Connecticut River Watershed issues, including programs on:

- Greenways, Byways, and River Protection;
- Water Quality;
- Stream and Habitat Preservation;
- Land Use and Growth Trends;
- Economic Development;
- Public Access and Recreation;
- Outreach and Education.

7. SUMMARY OF VOLUME II OF CONNECTICUT RIVER STRATEGIC PLAN

PROJECTS

Volume II of the Connecticut River Strategic Plan contains the final reports for seven distinct watershed projects, completed by Watershed Team members, and funded under the EOEA Watershed Initiative Comprehensive Grant. A brief description of the project reports is provided in this section. For specific details please refer to the individual reports in Volume II, which is available by request from PVPC.

Creation of a Literature Database and Internet Website

Connecticut River Watershed Council (CRWC) prepared a master list of relevant organizations for the watershed. A survey was then sent to each group requesting information about organizational goals, typical responsibilities and activities, workshops and publications, membership and staffing levels, and other relevant information. The resulting document is entitled "Connecticut River Environment"

Public Outreach, Communication, and Grassroots Involvement in the Watershed Plan

In coordinating the education and outreach component of the program, CRWC devised an outreach work plan that sought to gather input from citizen's about managing the watershed and to guide the development of the Strategic Plan. The outreach plan included:

- Establishing a Civic Leader Network of town leaders, planning board and conservation commission members, stream team participants, sub-watershed associations, and business leaders.
- An Internet site and a newsletter were created to serve as communications mechanism for interaction with the civic network.
- The Civic Leader Network was surveyed about technical assistance needs, community, priority water quality problem areas, and other issues.
- Workshops were organized to give network members the opportunity to learn about environmental issues and programs.
- A small grants database was developed describing existing Federal and State grant programs related to watershed management.

Water Quality Assessment and Sampling

This task was completed by the Massachusetts Water Resource Research Center (MAWRRC), and included design and implementation of a watershed-wide monitoring program. The Water Resource Research Center reviewed water quality data currently available for the main stem of the Connecticut River in Massachusetts and the lower reaches of its major tributaries, in order to guide future monitoring.

A sampling effort known as the "Swimming Hole Project" was conducted. Sampling sites were selected on the Connecticut River that sustain a high level of recreational use. The sampling program focused on fecal coliform bacteria due to its potential impact on human health and recreation. Elements of the program included the use of trained volunteer monitors, free analysis by community waste water treatment plant laboratories, and an extensive reporting of results to the public through newspaper articles and posting of signs at sampling sites.

Assessing Water Quality and Threats to Water Resources in the Mill River (Hatfield) Watershed

The focus of this project is the Mill River that drains parts of Conway, Deerfield, Whately, Hatfield, and Northampton on the west side of the Connecticut River. The Mill River Watershed Project used a broad partnership involving primarily UMASS Extension, Smith College, Franklin Regional Council of Governments, the Natural Resources Conservation Service (USDA), and Silvio 0. Conte National Fish & Wildlife Refuge. The goal of the project was to make science, research, and planning resources available to local officials and their communities to help them develop and carry out effective watershed protection measures. Project partners worked together to:

- Assess water quality and habitat conditions in the river and its tributaries;
- Identify opportunities to protect farmland and forest health, and to enhance wildlife habitat and recreational values;
- Provide local officials with sound scientific information to back up their decisions about how to protect watershed resources;

- Offer young people an opportunity to learn about the environment and to develop a sense of responsibility for their communities,
- Develop a coordinated approach to resource protection across town boundaries, including formation of a Mill River Watershed Council. The council will develop a long-term plan based on the information brought by this project.

Mill River Open Space Mapping and Analysis

The Pioneer Valley Planning Commission completed the Mill River (Hadley) Open Space Mapping and Analysis project. The purpose was to develop a method of prioritizing parcels within the Mill River watershed for open space protection as a demonstration of planning that could be used in the larger Connecticut River watershed. The selection of parcels for open space protection were guided by the goals of the project, which are to provide long-term protection of the water quality and wildlife habitat within the Mill River watershed.

Urban Stream Assessment Project

This project was completed by Pioneer Valley Planning Commission and involved a heavily urbanized stream, Tannery Brook in Holyoke. The project goal was to identify ways to restore water quality by enhancing the natural functions of the stream. The project sought to find solutions to identified stream problems by gathering information on the existing conditions of the watersheds, including modeling of stream flows, in order to address stormwater runoff, erosion and sedimentation, wetlands degradation, and flooding.

Wetlands Functional Deficit Analysis of the Mill River Watershed

This project was completed by the Franklin County Regional Council of Governments and involved the an analysis of wetlands in the Mill River Watershed of Hatfield, Conway, Deerfield, Whately, Northampton and Williamsburg. FRCOG mapped and classified wetlands, and assessed wetland functions, leading to conclusions and recommendations. Recommendations included reduction in road runoff and other non-point pollution, restoration of woody riparian stream buffers, eradication of non-native invasive species, removal of direct livestock access to the Mill River and restoration of wetlands.

1.0 THE CONNECTICUT RIVER STRATEGIC PLAN

1.0 INTRODUCTION

The Connecticut River Strategic Plan (CRISP) has been developed based on ideas generated by a two-year public outreach process, including public brainstorming sessions and a survey of civic leaders. The results of this outreach process were synthesized by the Pioneer Valley Planning (PVPC), with the assistance of the Connecticut River Watershed Council (CRWC), Franklin Regional Council of Governments (FRCOG), Massachusetts Water Resource Research Center (MA WRRC), and the University of Massachusetts Extension (UMASS Extension), with the support of the Massachusetts Executive Office of Environmental Affairs (EOEA).

1.1 PUBLIC RESPONSE AND PARTICIPATION

The Connecticut River Strategic Plan was guided by the involvement of hundreds of residents who participated in workshops and public surveys throughout the planning process. A Watershed Survey was completed in 1999 of civic leaders in all Massachusetts communities in the Connecticut River mainstem watershed to establish the top priority problems and goals for the watershed. A large watershed-wide public forum was held in Hadley, Massachusetts in November, 1998 to identify priority problems and to brainstorm possible solutions. Ideas from this public involvement were organized and refined in this report by the lead organizations and staff. Each of the report Chapters 2-5 includes Priority Goals and Priority Problems, based on this public involvement. Overall goals for the plan are summarized below.

1.2 OVERALL GOALS FOR THE STRATEGIC PLAN

Based on a Watershed Survey of civic leaders in all Massachusetts communities in the Connecticut River main stem watershed, the following are the most important overall goals for the Connecticut River watershed over the next ten to twenty years (ranked in order of priority):

1) improve water quality;
2) protect open space and farmland along the river;
3) control growth and development along the waterways;
4) improve public access to the river;
5) balance recreational use with protection of wildlife habitat and private property;
6) enlist the support of state and federal representatives to secure a "fair share" of state and federal funds;
7) clean up degraded urban riverfront lands;
7) promote increased environmental awareness among local officials, boaters and landowners;
9) improve wildlife habitat;
10) ensure adequate upstream fish passage;
11) restore river buffer areas;
12) maintain flow levels to reduce streambank erosion and maintain fish habitats;
13) achieve more effective enforcement of existing laws and regulations;
14) promote the river as an economic development asset.

1.3 ORGANIZATION OF THE PLAN

This Strategic Plan for the Connecticut River mainstem in Massachusetts is divided into five sections as follows:

A. Water Quality and Quantity;
B. Preservation of Streams and Wildlife Habitat;
C. Land Use, Growth Trends, and Economic Development;
D. Public Access, Recreation, and Greenways; and
E. Coordination and Watershed Management Partnerships.

Within each of these broad categories there is a set of stakeholder goals and issues, an assessment of the current conditions in the watershed, recommended strategies to improve watershed management, and specific actions to be taken. In addition, many of the past reports, studies, and existing programs in the watershed are described within each category.

1.4 THE CONNECTICUT RIVER WATERSHED

The Connecticut River is the longest river in New England, flowing 400 miles from the Canadian border through Vermont and New Hampshire, 66 miles through Massachusetts, and through Connecticut before eventually draining into Long Island Sound. The dam at Holyoke divides the Massachusetts portion of the river into two distinct segments. The northern segment of the Massachusetts reach runs through primarily rural villages and agricultural areas whose integrity is increasingly threatened by suburban sprawl. Below the Holyoke Dam, the landscape is intensely urbanized, as the river flows through the Springfield-Chicopee-Holyoke metropolitan area.

The mainstem of the Connecticut River in Massachusetts, as defined by the Commonwealth, drains 660 square miles and portions of 44 communities. Four large river watersheds, the Deerfield, Millers, Westfield, and Chicopee, have their confluence in the Connecticut River. In addition to these four major tributaries, there are 13 moderate sized tributaries and numerous small streams draining to the Connecticut. For the purposes of this effort, the watershed planning area has been defined as the mainstem watershed only.

In Massachusetts, the Connecticut River Valley is also known as the Pioneer Valley. The river is one of the region's premier environmental and recreational assets. One of the first rivers in the New World to be explored by Europeans, its fertile valley nourished the region's development, and its currents fired the industrial mills that drove the region. The lower, urban reach of the river is the most populous segment of the river in Massachusetts.

The flat floodplains of the Connecticut Valley are some of the state's most productive farmlands. Many diverse geological characteristics provide habitat that attracts species not found elsewhere in the state. Channel changes over the years have left oxbows in the river's former course. Waterfowl migrating along the Atlantic flyway use the river as an important resting and feeding area. The American bald eagle and the once threatened osprey are frequently sighted along the river corridor. The river supports many fish species including trophy-sized northern pike, large and smallmouth bass and the endangered shortnose sturgeon.

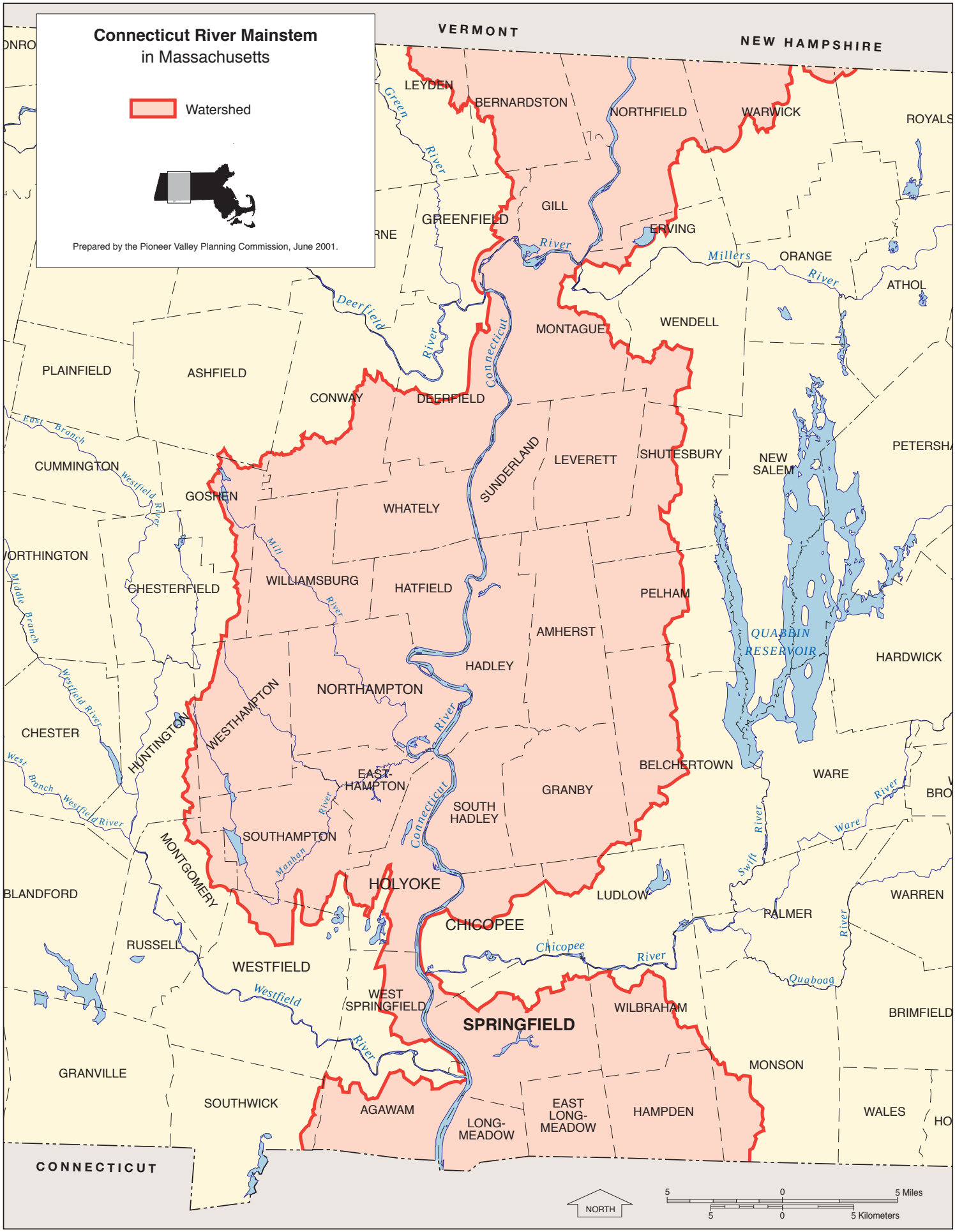
The river and adjacent lands provide an abundance of opportunities for boating, fishing, and other recreational activities. Faced with the continuing development pressure in the Connecticut River valley, federal, state and local governments have initiated programs aimed at the preservation of beautiful and fertile farmlands, lush forest habitats and traditional New England villages.

The river holds enormous opportunities to become a focal point for our region's urban life, recreation, tourism, and economic development. As a regional resource, the river will require extraordinary financial resources and creative management strategies to successfully address these competing demands with clean water and habitat protection. Consequently, no single community acting alone can be expected to successfully address river issues.

1.5 THE MASSACHUSETTS WATERSHED INITIATIVE

The Massachusetts Executive Office of Environmental Affairs adopted the Watershed Initiative to build watershed-based partnerships to better protect the state's environmental quality. The watershed approach is an integrated ecosystem management methodology based on the 27 major watersheds in Massachusetts. The methodology includes the following characteristics:

- Geographically defined management: The area of management activity is defined by watersheds.
- Local people solving local problems: Assessment and problem solving is informed by input from the local watershed association, other civic groups, business, commerce, and citizens at large. Municipal, state, and federal governments provide assistance where possible.
- Partnership of watershed stakeholders: Government agencies and community stakeholders work cooperatively, seek consensus, and share responsibility and credit when identifying problems, defining solutions, and implementing action.
- Guidance by science and input: Sound science guides all phases of watershed management. Public outreach and participation occurs to assist in problem identification and solution proposals as well as to promote local awareness and understanding of the watershed issues.
- Watershed based prioritization: Limited resources are targeted to the unique priority issues in each watershed.


Connecticut River Mainstem
in Massachusetts
Watershed
Prepared by the Pioneer Valley Planning Commission, June 2001.
VERMONT
NEW HAMPSHIRE
CONNECTICUT
LEYDEN
BERNARDSTON
NORTHFIELD
WARWICK
ROYALS
Green River
GREENFIELD
GILL
ERVING
Millers River
ORANGE
ATHOL
Deerfield River
MONTAGUE
WENDELL
Connecticut River
PLAINFIELD
ASHFIELD
CONWAY
DEERFIELD
East Branch
CUMMINGTON
Westfield River
GOSHEN
WHATELY
SUNDERLAND
LEVERETT
SHUTESBURY
NEW SALEM
PETERSHA
ORTHINGTON
Middle Branch
CHESTERFIELD
Mill River
WILLIAMSBURG
HATFIELD
PELHAM
AMHERST
QUABBIN RESERVOIR
HARDWICK
HADLEY
NORTHAMPTON
WESTHAMPTON
HUNTINGTON
CHESTER
West Branch Westfield River
Manhan River
EAST HAMPTON
SOUTH HADLEY
GRANBY
BELCHERTOWN
WARE
Swift River
Ware River
BRO
SOUTHAMPTON
MONTGOMERY
BLANDFORD
HOLYOKE
LUDLOW
WARREN
PALMER
CHICOPEE
Chicopee River
RUSSELL
WESTFIELD
Westfield River
Quaboag River
WEST SPRINGFIELD
SPRINGFIELD
WILBRAHAM
BRIMFIELD
GRANVILLE
SOUTHWICK
AGAWAM
LONG-MEADOW
EAST LONG-MEADOW
HAMPDEN
MONSON
WALES
NORTH
5 0 5 Miles
5 0 5 Kilometers

1.6 PURPOSE OF THE CONNECTICUT RIVER STRATEGIC PLAN

The Connecticut River Strategic Plan suggests an approach for implementing a watershed management initiative in the Massachusetts reach of the Connecticut River valley. Its purpose is to integrate protection of the valley's natural resources with local, regional, state, interstate, and national protection efforts. Strategies are identified that can be implemented to achieve this purpose as well as the goals of the MA Watershed Initiative. The broad goals of the Strategic Planning effort are to:

1. Raise grassroots awareness of environmental issues related to the Connecticut River in order to facilitate watershed management at the local level;
2. Create a management and protection approach for the watershed that is community based, but transcends local and regional boundaries;
3. Develop an approach to watershed management that makes the best use of limited organizational resources, and;
4. Identify the important issues for the Connecticut River Basin team and others working in the watershed.

Some of the general objectives of the Strategic Plan are to:

1. Increase the capacity of grassroots organizations to work on watershed environmental issues through education, information sharing, and technical support;
2. Improve communication and working relationships between all watershed interests;
3. Strengthen the EOEA Connecticut River Watershed Team working partnerships through collaboration on specific work tasks;
4. Develop a Strategic Plan that guides resource agencies in the process of watershed management;
5. Identify specific roles and actions that a watershed community council can adopt to provide improved watershed management;
6. Strengthen mechanisms for rallying public support and increasing and coordinating state and federal technical and financial assistance to protect and enhance the environmental quality of the Connecticut watershed.

1.7 REGULATORY ROLE IN THE WATERSHED APPROACH: THE CLEAN WATER STRATEGY

The voluntary, grassroots work done by community members is the heart of the Watershed Initiative, but there is also a regulatory component, as the state's mandates under the Federal Clean Water Act are integrated with grassroots leadership.

The objective of the Federal Water Pollution Control Act (commonly known as the Clean Water Act or CWA), is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. The CWA requires states to develop information on the quality of the nation's water resources, and report this information to the U.S. Environmental Protection Agency (EPA), the U.S. Congress, and the public. The Massachusetts Department of Environmental Protection, in conjunction with the EPA, is responsible for implementation of CWA mandates, and the five-year cycle of the watershed approach described here provides the management structure to carry them out.

YEAR 1: Identification and compilation of available information to describe watershed conditions, resources and issues. Development of an environmental monitoring plan. (The Connecticut River began Year 1 of the five year cycle in 1997).

YEAR 2: Implementation of environmental monitoring plan for field sampling and laboratory analysis (Connecticut River - 1998).

YEAR 3: Assessment of water quality conditions, determination of causes and sources of use impairment (Connecticut River - 1999).

YEAR 4: Developing and implementing the water pollution control strategies (Connecticut River - 2000).

YEAR 5: Evaluation (Connecticut River - 2001).

In addition to the MA Clean Water Strategy, which has been developed to meet the requirements of the CWA, the various state environmental agencies and municipalities administer regulatory and non-regulatory programs that play an important role in watershed management. These programs include state wetlands laws, land acquisition programs and permitting activities such as those conducted by the Massachusetts Environmental Policy Act (MEPA) unit.

1.8 AGENCY AND ORGANIZATIONAL ROLES

On a daily basis, many state, regional, and federal agencies, along with non-profit and educational organizations and communities are working together to improve and protect the Connecticut River Watershed. The following is a brief summary of the roles (relative to the Connecticut River Strategic Plan) of those organiza-

tions involved with the Connecticut River Watershed Team:

- Mass. Executive Office of Environmental Affairs: administers Mass. Watershed Initiative, and associated grant programs, provides Watershed Team leaders;
- Mass. Division of Fisheries, Wildlife and Environmental Law Enforcement: provides Riverways technical assistance and small grants to communities and non-profits;;
- Mass. Department of Environmental Protection: enforcement agency for water quality laws, oversees many state/federal water quality grant programs;
- Mass. Department of Environmental Management: manages Connecticut River Greenway State Park, coordinates efforts to protect riverine lands, provides small Greenways grants;
- University of Massachusetts Extension:
- Connecticut River Watershed Council: advocates for river, educates and informs public, lead agency for American Heritage Rivers designation, undertakes river projects;
- Regional Planning Agencies: provide assistance to communities in addressing river and water quality issues, seek funding and coordinate projects for water quality assessment and improvement;
- USDA Natural Resources Conservation Service: provides technical assistance on erosion and other water quality issues;
- River Navigator: coordinates federal assistance for river projects under the American Heritage Rivers Program;
- Mass. Water Watch Program: coordinates volunteer citizen water quality monitoring projects;
- U.S. Fish and Wildlife Service, Silvio Conte National Fish and Wildlife Refuge: manages Conte Refuge, coordinates Atlantic salmon restoration efforts, provides small grants program;
- Hampshire, Hampden, Franklin County Conservation Districts: provides technical assistance on erosion and other water quality issues.

1.9 EOEA BASIN TEAM

Under the MA Watershed Initiative, an appointed River Basin Team Leader is charged with forming a Basin Team for the Watershed. In accordance with the goals of the Watershed Initiative, the Basin Team should be comprised of representatives from a variety of private and public, local, state and federal agencies and organizations, to insure the variety of stakeholders within the watershed are represented.

John O'Leary is the Team Leader for the Connecticut River Watershed Team. Other regular Team members include:

- Russ Cohen, Mass. Department of Fisheries, Wild life, and Environmental Law Enforcement
- Scott Jackson, University of Massachusetts Extension
- Whitty Sanford, Connecticut River Watershed Council
- Chris Curtis, Pioneer Valley Planning Commission
- Joe Dunn, Franklin Regional Council of Governments
- Jerry Schoen, Mass. Water Watch Program, University of Massachusetts
- Bob McCollum and Larry Golonka, Mass. Department of Environmental Protection
- Oliver Miranda, Diane Leone, Rita Thibedeau, USDA Natural Resources Conservation Service
- Dan Burke, Connecticut River Navigator
- Jennifer McDonald, Jerzy Pietrzak, Dave Clark, Mass. Department of Environmental Management
- Beth Goettel and Janice Rowan, U.S. Fish and Wildlife Service
- Gene Mills, Hampshire, Hampden, Franklin County Conservation Districts

The Team has identified the top five issues in the Connecticut River Watershed as:

1) Protection and creation of riparian buffers
2) Elimination of combined sewer overflows (CSOs) in the Springfield, Chicopee and Holyoke reach of the river
3) Restoration of river continuity, by eliminating barriers to fish passage within tributary waters.
4) Reduction of negative impacts due to stormwater runoff
5) Improvement of limited water quality throughout the watershed

The following is a sampling of the projects the Team is involved with:

1) Hampshire, Hampden and Franklin Conservation District Alternative Livestock Watering System and Stream Fencing Demonstration Project;
2) Grant application to Massachusetts Environmental Trust for outreach materials and public forum on the value of the Connecticut River as a public resource, to heighten awareness of the importance of cleaning up the CSO problem.
3) Funding the construction of five eelways throughout the watershed.
4) Funding construction of a fish bypass channel around a dam on the Sawmill River.
5) Team member PVPC has taken the lead in development of a model local Stormwater Utility to fund cleanup projects.
6) New England Interstate Water Pollution Control Commission has begun to collect PCB fish tissue data throughout the entire Connecticut River watershed in the same way for the first time ever.

2.0

WATER QUALITY AND QUANTITY

2.1 PUBLIC RESPONSE AND PARTICIPATION

As noted in the Introduction, the *Connecticut River Strategic Plan* was guided by the involvement of hundreds of residents who participated in a Watershed Survey completed in 1999, and a large watershed-wide public forum held in in November, 1998 to identify priority problems and to brainstorm possible solutions. Each report chapter includes Priority Goals and Priority Problems, based on this public involvement.

Priority Water Quality Goals

Based on a Watershed Survey of civic leaders in all Massachusetts communities in the Connecticut River main stem watershed, the most important water quality goals for the Connecticut River are (ranked in order of priority):

1) **improve water quality within the Connecticut River and its tributaries;**
2) **increase state and federal funding for water quality;**
3) **bring all segments up to Class B ("fishable and swimable") water quality;**
4) **reduce polluted runoff to the mainstream and tributaries;**
5) **increase public awareness of adverse impacts of water supply withdrawals, dam releases and other human caused fluctuations or reductions in streamflow;**
6) upgrade existing wastewater treatement facilities, and ;
7) improve the management of stream flows on Connecticut River tributaries to achieve maximum benefits for people and nature.

Priority Water Quality Problems

The most significant water quality problems identified by civic leaders are as follows (ranked in order of priority):

1) **stormwater runoff from developed areas;**
2) **combined sewer overflows;**
3) **riverbank erosion and sedimentation;**
4) **runoff of pesticides and fertilizers from lawns;**
5) **industrial wastes;**
6) agricultural pollution (e.g. pesticides, fertilizers, animal wastes);
7) recreational use (e.g. wakes from motorboats, trash);
8) wastewater treatment plant discharges, and;
9) acid precipitation (rain or snow);
10) construction-related runoff;
11) toxins in fish tissue;
12) lack of water quality monitoring data;
13) toxic chemical spills or releases;
13) excessive water withdrawals.

Based on the "Connecticut River Watershed Public Brainstorming Session" held 11-14-98 in Hadley, MA, the following issues were identified as top priority water quality concerns for residents of the watershed:

1) Combined Sewer Overflows (CSOs) - Specific concerns were expressed regarding bacterial and viral pollutant levels, aging sewage infrastructure and wastewater plants, and the lack of funding available for upgrading infrastructure.

2) Lack of Water Quality Data - Specific concerns were expressed regarding the lack of sufficient baseline data to characterize current water quality conditions, the need for a formalized method of monitoring, the need

for a study design to benchmark future changes, and the need to analyze sediments.

3) Polluted Runoff - Specific concerns were expressed regarding agricultural runoff (pesticides, soil erosion and nutrients), urban runoff (salt, metals, organics), increases in impervious surfaces, lawn fertilizers, road salting and sanding, roadside herbicide spraying, private septic tanks and brownfield runoff.

4) Soil Erosion - Specific concerns were expressed about erosion from new construction sites, bridge and road construction, and from removal of streambank vegetation.

5) Better Regulations and Enforcement – Specific concerns were expressed about lack of enforcement of existing regulations, the need for better organized inter-agency enforcement

6) Protection of Drinking Water Supplies

2.2 ASSESSMENT OF THE CURRENT SITUATION

2.20 Water Quality Improvements in Past 25 Years

The passage of the Clean Water Act of 1972 has had a positive impact on the water quality in the Connecticut River. A New York Times reporter in the 1960's gave the Connecticut River the now-infamous description of being "the nation's best landscaped sewer." A steady stream of municipal and industrial wastes, including solids, organic wastes, process dyes, chromium, lead and cyanides, grossly polluted the river. Discharges from aging primary treatment plants and combined sewer overflows resulted in coliform bacteria counts over 2000 times higher than the state standard. Dissolved oxygen, essential for aquatic life, was almost totally absent from the river.

By the mid-1980's, more than $333 million in public funds had been expended on extensive clean-up activities and wastewater treatment improvements (Rediscovering the River, An Action Plan for the Urban Reach of the River, DEM, PVPC, NPS, September, 1987). Private industries in Hampden and Hampshire Counties had expended $22 million to construct their own wastewater facilities. These efforts improved the water quality in 80% of the Connecticut River in Massachusetts to Class B (fishable/swimmable) standards, with the exception of combined sewer overflow inputs in the southerly 20% of the river within Massachusetts. Each of the 23 communities discharging to the Massachusetts reach of the Connecticut River now has at least secondary treatment. In 1997, dissolved oxygen readings were found to meet or exceed Class B standards at all sites tested from Sunderland to Chicopee (*Application for New License for the Holyoke Hydroelectric Project,* R.W. Beck, Inc., for Ashburnham Municipal Light and MMWEC, August 1997).

2.21 Water Quality Data

There is a lack of current, comprehensive water quality sampling data for the Connecticut River main stem in Massachusetts, due to a severely curtailed DEP water quality monitoring program. The most recent DEP sampling was a limited mini-survey on the lower river in 1993 and a survey on the upper river in 1990. The U.S. Geological Survey under the National Water Quality Assessment Program (NAWQA) also conducted sampling, but sampling sites along the Connecticut River main stem in Massachusetts were limited. This has been supplemented to some degree by more recent sampling done for the Holyoke Dam hydropower relicensing process by license applicants. Consequently, we are handicapped by the paucity of data in scientifically assessing the river's water quality problems.

Water quality data that is available has not been compiled in a single source document, nor is it readily accessible to the general public. In other cases, such as USGS reports, water quality data is presented without analysis or in a form that is not designed for consumption by the general public. Information, for example, is needed to build public support for taking on the burden of financing CSO clean up. People need to understand how their lives can be tangibly improved by spending money for a cleaner river.

2.22 Current Water Quality Status

In 1995, the Massachusetts Department of Environmental Protection (DEP) noted in its report, *Connecticut River Watershed Resource Assessment and Management Report* (DEP Office of Watershed Management, March 1995), "the water quality of the entire length of the Connecticut River main stem in Massachusetts does not support uses designated for Class B (fishable/swimmable) waters. This non-support status is due to the presence of priority organics ,in particular, PCBs (polychlorinated byphenols), which violate DEP's new water quality standards for organics, and in several areas, pathogens (as measured by coliform bacteria) and suspended solids primarily from urban runoff, combined sewer overflows and unknown sources."

A more detailed 1997 water quality monitoring study completed on the Connecticut River at 15 sites between Sunderland and Chicopee during four different seasons/events by R. W. Beck, Inc. (*Application for New License for the Holyoke Hydroelectric Project, R.W. Beck, Inc., for*

Ashburnham Municipal Light and MMWEC, August 1997) concluded that water quality within the study area was found to be failing to meet federal standards, due to elevated fecal coliform, lead and copper concentrations. "Fecal coliform counts were higher than the standards at several sites during each sampling" with concentrations "too numerous to count" in some locations at both low and high flow periods. These occurred primarily below the Holyoke Dam, but violations were also found in the Northampton area. During a December 1996 storm event, the coliform standard was exceeded at 13 of 15 stations. These violations "are expected to be the result of wastewater discharges and combined sewer overflow discharges." The Beck study also found "lead and copper concentrations exceeded chronic concentration standard on several occasions at several locations".

In a 1997 report, the New England Interstate Water Pollution Control Commission *(The Health of the Watershed, NEIWPCC, January 1997)* noted that the key water quality issues on the Connecticut River in Massachusetts are: CSOs in the segment below the Holyoke Dam; PCBs in fish in the entire length of the river; coal tar in the river in Holyoke; and flow regulation and fish passage above the Turners Falls Dam.

There are several issues of interstate concern on the Connecticut River, most notably, interstate impacts of nitrogen loading and combined sewer overflows. Connecticut's Department of Environmental Protection has been involved in a 10-year study of the Long Island Sound, which has concluded that the Long Island Sound watershed, including the Connecticut River, must reduce nitrogen loads by 58% in order to reverse eutrophication and approach dissolved oxygen standards in the Sound. Detailed studies of nitrogen loading have not been conducted in Massachusetts, Vermont or New Hampshire, but it is estimated that the total contribution of enriched nitrogen loading from these three states is significantly less than the amount equivalent to a 58% reduction. Further data collection and modeling is needed, but there is pressure on Massachusetts to take action. In the fall of 1998, Massachusetts initiated a study of the nitrogen loading for both urban and rural watersheds tributary to the Connecticut River, and subsequently to Long Island Sound.

Table One. Connecticut River Water Quality Summary By Reach

Reach	Class	Status	Causes	Source
New Hampshire line to	B/WWF	NS	Priority Organics	Source unknown
Northfield			Pathogens	
Northfield to Montague	B/WWF	NS	Priority Organics	Source unknown
Montague to Greenfield	B/WWF	NS	Priority Organics	Source unknown
Greenfield to Holyoke	B/WWF	NS	Pathogens Priority Organics	Urban runoff/ storm sewers Sources unknown
Holyoke to Connecticut state line	B/WWF	NS	Pathogens Suspended solids Priority organics	Combined sewer overflows Urban runoff/ storm sewers Source unknown

Notes: 1. B/WWF - suitable for fishing, swimming and warm water fisheries
2. NS - non-supporting (i.e. failing)
3. The upper Connecticut River in Massachusetts was meeting Class B water quality standards until recently when water quality classification criteria were revised to include organics, such as PCBs.

Source: *Commonwealth of Massachusetts Summary of Water Quality*, Mass. Department of Environmental Protection, 1992

The Holyoke Water Power Company study *(Holyoke Project, Application for a New License for Major Project Existing Dam, Holyoke Water Power Company,* August 1997) notes that "although discharges of polychlorinated biphenyls (PCBs) ceased in the 1970s, PCBs are persistent and remain in the Connecticut River. As such, the Massachusetts Department of (Public Health) has issued an advisory for consumption of channel catfish caught in the river. The source of PCB contamination was most likely from a paper company located on the Millers River".

Combined sewer overflow impacts are also of interstate significance, given that the greater Hartford metropolitan area has largely completed an $80 million Connecticut River combined sewer clean-up program, while Massachusetts has not made as much progress on its upstream CSO problems.

Generally speaking, the water quality in the tributaries is higher, with the notable exception of the PCB contamination in the Millers River (which is a tributary with it own basin team). The influx of cleaner water from the small tributaries helps to dilute pollutants in the mainstem. It is important to maintain this water quality in tributary streams for their own sake as well as for the mainstem. (See water quality data for streams in Table 2).

Point and Nonpoint Source Pollution

Nonpoint source pollution is a term for polluted runoff. Water washing over the land, whether from rain, snowmelt, car washing or the watering of crops or lawns, picks up an array of contaminants including oil and sand from roadways, agricultural chemicals from farmland, and nutrients and toxic materials from urban areas. This runoff enters our waterways, either directly or through storm drain collection systems.

Point source pollution comes from specific sources such as sewage treatment plants or industrial facilities. Although substantial progress has been made in cleaning up major point sources, an increasingly larger share of pollutants getting into our waterways is attributable to urban runoff and other nonpoint sources. In fact, the Environmental Protection Agency has estimated that this type of pollution is now the single largest cause of the deterioration of our nation's water quality

2.23 Results from the "Swimming Hole Project"

The Massachusetts Water Watch Partnership (MWWP) led a volunteer water quality monitoring project (the "Swimming Hole Project") on the Connecticut River in the summer of 1998, as part of the EOEA grant which funded this report. Citizen volunteers sampled 12 sites biweekly to test the Massachusetts portion of the Connecticut River for fecal coliform bacteria, an indicator of possible pathogenic health risks from water contact. All sites sampled are considered to receive a high degree of use for swimming, boating, fishing and other river recreation. The samples were brought to one of three cooperating municipal wastewater treatment plants in Montague, Amherst, and Chicopee for analyses. The last and final sampling occurred September 14, 1998.

This study focused only on potential health impacts related to possible disease bearing organisms. MWWP did not attempt to examine other issues such as nutrient loadings, toxic substances, or other potential problems. All findings, conclusions and recommendations pertain solely to health-related use of the river for recreational purposes.

The major findings of the MWWP study were that, relative to fecal coliform bacteria:
– Water quality appears to be worse on wet days than on dry days.
– During dry weather, the river generally appears to beclean enough to support swimming, fishing, boating, and similar recreational uses.
– MWWP found no significant difference in water quality between the upstream, rural areas and downstream, urbanized sites (although this was based on very limited data collection in the Springfield urbanized area).

The MWWP study concluded that the river, at the sites tested, generally supports recreational use during dry weather, and that particular caution should be exercised during wet weather conditions.

MWWP released results to local news media after every sample event, posted signs at several river access points, and posted results on the MassWWP Web site (http://riga.fnr.umass.edu/tei/Mwwpage). The response, evidenced by calls received from press, the general public, interested organizations and agencies, and by the number of visits to the Web site, indicates widespread interest in the condition of the river.

The MWWP Swimming Hole Project was not intended to locate sources of contamination. MWWP recommends:

- Further studies to identify and/or measure these contamination sources during high water periods.

- Further study to measure the length and magnitude of rain events that affect water quality. Land and water use and treatment programs would do well to concentrate on preventing or controlling pollution that stems from weather-related high water conditions. MWWP found the general water quality picture good and promising.

- Encouraging area residents, visitors, environmental officials, organizations and planners to recognize the Connecticut as a river that, in its present state, can with reasonable caution, be considered a valuable recreational resource. Planning efforts that assume a healthy river and that take steps to safeguard and improve the river's health are likely to provide a boost to the area's economic well being, quality of life, and community pride.

The following table presents 1998 fecal coliform bacteria data in number of colonies per 100ml of water (preliminary results; may be altered after more thorough review of quality control results).

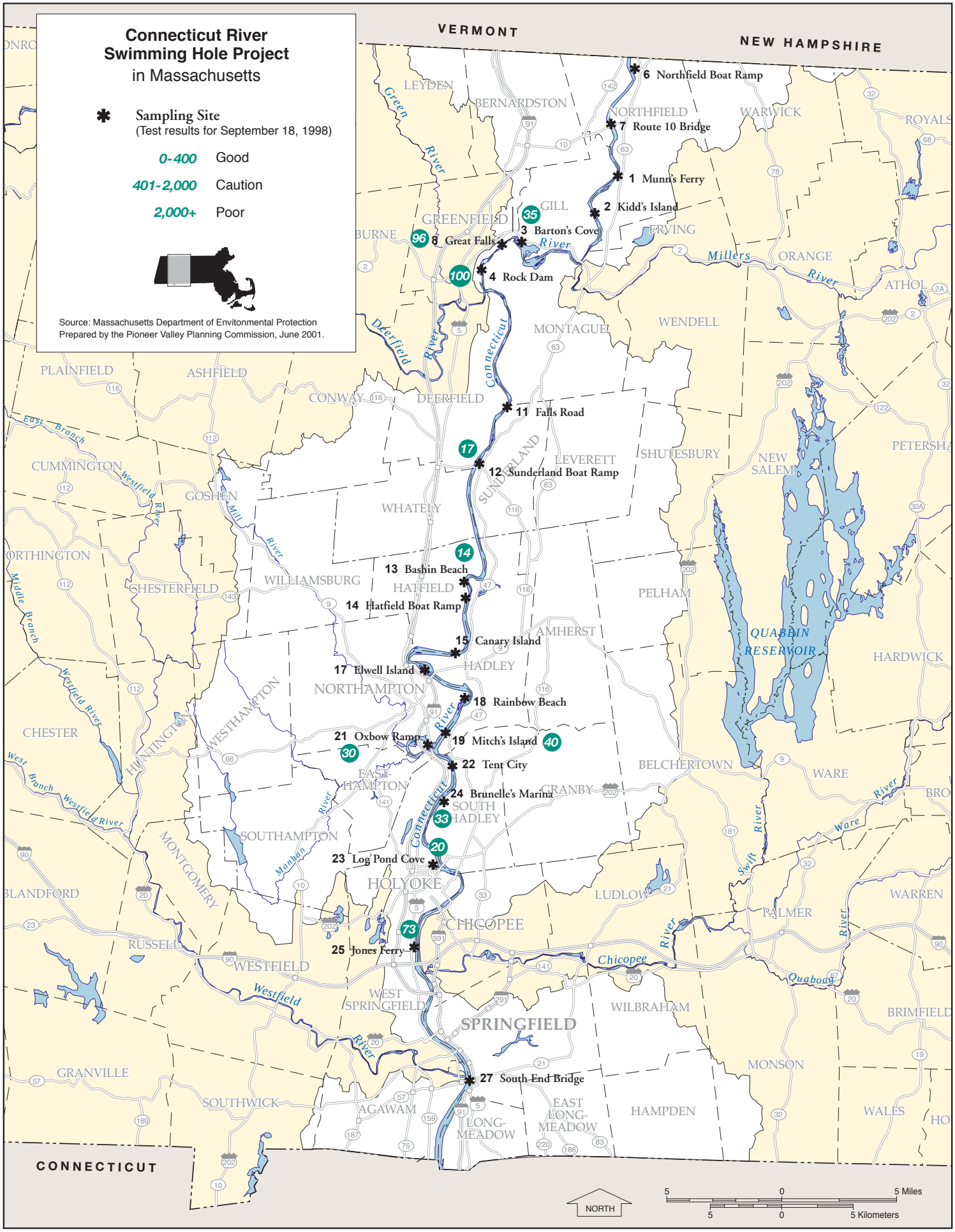
Table Two. Results from Swimming Hole Monitoring Project

Site	14-Jun	28-Jun	12-Jul	26-Jul	9-Aug	23-Aug	7-Sep	14-Sep
N'field Boat Ramp, Northfield	ns	1900	ns	42	ns	ns	ns	ns
Rt 10 Bridge, Northfield	ns	ns	ns	ns	6	ns	1460	ns
Munn's Ferry, Northfield	520	ns	18	22	11	11	92	ns
Kidd's Island, Northfield	648	1733	4	11	5	16	ns	ns
Barton Cove, Gill	7	28	7	ns	2	4	11	35
Great Falls, Turners Falls	ns	ns	ns	ns	ns	ns	ns	96
Rock Dam, Turners Falls	420	600	16	60	ns	nd	166	100
Falls Rd, Sunderland	380	ns	ns	17	18	ns	ns	ns
Rt 116 Bridge, Sunderland	ns	600	ns	ns	ns	13	2600	17
Bashin Beach, Hatfield	400	285	32	14	19	27	7	14
Canary Island, Hatfield	760	280	36	12	20	ns	27	ns
Elwell's Island, Northampton	60	220	67	50	15	60	ns	ns
Rainbow Beach, Northampton	ns	ns	ns	ns	ns	115	ns	ns
Mitch's Island, Hadley	ns	ns	ns	0	ns	ns	ns	40
Oxbow Ramp, Northampton	6000	520	66	ns	39	ns	180	30
Tent City, Hadley	ns	ns	112	ns	ns	120	ns	ns
Brunelle's Marina, S. Hadley	ns	377	ns	ns	98	540	230	33
Log Pond Cove, Holyoke	320	ns	91	96	ns	ns	73	20
Jones Ferry, Chicopee	2900	147	82	49	3	367	96	73
South End Bridge, Agawam	4950	131	0	23	28	49	ns	ns
ns=not sampled; nd=no data								

Massachusetts Standards for Fecal Coliforms*:

under 400 colonies/100ml: suitable for primary water contact (swimming)
400-2000 colonies/100ml: suitable for secondary contact only (boating, but no swimming)
over 2000 colonies/100ml: unsuitable for recreation (no boating or swimmimng)

*These are simplified standards for easy reading.


Connecticut River
Swimming Hole Project
in Massachusetts
Sampling Site
(Test results for September 18, 1998)
0-400 Good
401-2,000 Caution
2,000+ Poor
Source: Massachusetts Department of Environmental Protection
Prepared by the Pioneer Valley Planning Commission, June 2001.
VERMONT
NEW HAMPSHIRE
CONNECTICUT
6 Northfield Boat Ramp
7 Route 10 Bridge
1 Munn's Ferry
2 Kidd's Island
3 Barton's Cove
8 Great Falls
4 Rock Dam
11 Falls Road
12 Sunderland Boat Ramp
13 Bashin Beach
14 Hatfield Boat Ramp
15 Canary Island
17 Elwell Island
18 Rainbow Beach
21 Oxbow Ramp
19 Mitch's Island
22 Tent City
24 Brunelle's Marina
23 Log Pond Cove
25 Jones Ferry
27 South End Bridge
LEYDEN
BERNARDSTON
NORTHFIELD
WARWICK
ROYALSTON
GILL
GREENFIELD
ERVING
ORANGE
ATHOL
MONTAGUE
WENDELL
PLAINFIELD
ASHFIELD
CONWAY
DEERFIELD
SHUTESBURY
NEW SALEM
PETERSHAM
CUMMINGTON
GOSHEN
WHATELY
LEVERETT
SUNDERLAND
WILLIAMSBURG
HATFIELD
PELHAM
AMHERST
QUABBIN RESERVOIR
HARDWICK
NORTHAMPTON
HADLEY
CHESTER
HUNTINGTON
WESTHAMPTON
EAST HAMPTON
SOUTH HADLEY
GRANBY
BELCHERTOWN
WARE
SOUTHAMPTON
MONTGOMERY
HOLYOKE
LUDLOW
WARREN
PALMER
CHICOPEE
RUSSELL
WESTFIELD
WEST SPRINGFIELD
WILBRAHAM
BRIMFIELD
SPRINGFIELD
MONSON
GRANVILLE
SOUTHWICK
AGAWAM
LONG-MEADOW
EAST LONG-MEADOW
HAMPDEN
WALES
BLANDFORD
Green River
Deerfield River
Connecticut River
Millers River
East Branch Westfield River
Westfield River
Mill River
Middle Branch Westfield River
West Branch Westfield River
Manhan River
Chicopee River
Ware River
Swift River
Quaboag River
NORTH
5 0 5 Miles
5 0 5 Kilometers

2.24 Water Quality Data for Connecticut River Tributary Streams

The tributary streams to the Connecticut River in Massachusetts are generally in better condition than the river's main stem. Most tributaries support their designated uses, although most are also threatened by one or more pollution source. Weston Brook and Lampson Brook in Belchertown only partially support their designated uses.

The Massachusetts Department of Environmental Protection, in fulfillment of the State's requirement under section 305(b) of the Federal Clean Water Act, provides information about stream segments. The information is provided in the *Commonwealth of Massachusetts Summary of Water Quality: Appendix I – Basin/Segment Information*. The information is summarized in the following table.

Table Three. Connecticut River Quality Summary – Selected Streams

Stream	Size	Class	Status	Causes	Source
Temple Brook– Headwaters Monson confluence with Scanic River, Hampden	2.8 mi	B/WWF	S/T	Organic Enrichment/DO Pathogens Nutrients	Agricluture
Raspberry Brook – Headwaters, Enfield CT to confluence with CT River, Longmeadow	2.1 mi	B/WWF	S/T	Nutrients Organic Enrichment Siltation	Recreational activities Urban runoff/storm sewers
Longmeadow Brook – Headwaters to confluence with CT River, Longmeadow	4.3 mi	B/WWF	S/T	Pesticides Nutrients Organic Enrichment/DO Siltation	Source unknown
Cooley Brook – Headwaters to confluence with CT River, Longmeadow	1.4 mi	B/WWF	S/T	Nutrients Thermal modifications Siltation Pesticides	Urban runoff/storm sewers Land development Recreational activities
Stony Brook – Headwaters, Granby to confluence with CT River, South Hadley	13.6 mi	B/WWF	S (12.6) S/T (1.0)	Pesticides Nutrients	Recreational activities
Bachelor Brook – Outlet Forge Pond Granby to confluence with CT River South Hadley	9.1 mi	B/WWF	NA	Not listed	not listed
Weston Brook – Headwaters Belchertown to inlet Forge Pond, Granby	2.65	B/WWF	PS (1.40) NA (1.25)	Chlorine Organic enrichment/DO Nutrients Pathogens Unionized Ammonia	Urban runoff/storm sewers Onsite wastewater systems (septic systems Municipal Point sources

Table Three. Connecticut River Water Quality Summary – Selected Streams (cont'd)

Stream	Size	Class	Status	Causes	Source
Lampson Brook – Belchertown State Hospital WWTP to confluence with Weston Brook, Belchertown	0.9 mi	B/WWF	PS (0.4), NS (0.5)	Unionized Ammonia Chlorine Organic enrichment/DO Nutrients	Municipal Point Sources Urban runoff Septic Tanks
Manhan River – Headwaters Westhampton to outlet Tighe Carmody Reservoir, Southampton	15.2 mi	A/WWF	S/T	Nutrients Thermal modifications Siltation	Silviculture
Manhan River – Outlet Tighe Carmody Reservoir, Southampton to confluence with Connecticut River, Easthampton	10.9 mi	B/WWF	S/T	Siltation Organic enrichment?do Suspended solids Salinity/TDS/chlorides	Urban runoff/storm sewers Agriculture
Wilton Brook – Headwaters to inlet Nashawannuck Pond, Easthampton	1.6 mi	B/WWF	S/T	Nutrients Pathogens Organic enrichment/DO	Agriculture
White Brook– headwaters to inlet Nashawannuck Pond, Easthampton	1.9 mi	B/WWF	S/T	Nutrients Pathogens Organic enrichment/DO	Agriculture
Broad Brook – Headwaters Holyoke to inlet Nashawannuck Pond, Easthampton	10.9	B/WWF	S/T	Nutrients Organic enrichment/DO Siltation Pathogens Thermal modifications	Agriculture Harvesting restoration residue management
Long Plain Brook – Headwaters, Leverette to confluence with Russellville Brook, Sunderland	3.5 mi	B/WWF	S/T	Metals	Natural

Notes:B/WWF – suitable for fishing, swimming and warm water fisheries
NS – non-supporting
S – all designated uses supported, one or more uses threatened
S/T – all designated uses supported, one or more uses threatened
PS – Partially supporting one or more designated uses
NS – not supporting one or more designated uses

Additional Note: The stream segments not listed here were not assessed by DEP and may or may not meet their designated uses. This points out the need for more extensive water quality monitoring to assess these other streams.

Source: *Commonwealth of Massachusetts Summary of Water Quality*, Mass Department of Environmental Protection, 1992.

2.25 Other Impaired Water Bodies

Under requirements of the Clean Water Act, the Massachusetts Department of Environmental Protection prepares a 303d list of impaired water bodies on even-numbered years. Massachusetts has 1500 segments on this list. Segments must remain on the 303d list until water quality standards are met after TMDLs (Total Maximum Daily Loads) are implemented. The most recent 303d list is seen below.

Table Four. 303d List of Impaired Water Bodies in Connecticut River Basin

WATER BODY	303d IMPAIRMENT
Lakes and Ponds	
Aldrich Lake, Granby	Noxious aquatic plants
Arcadia Lake, Belchertown	Nutrients, noxious aquatic plants
Metacomet Lake, Belchertown	Organic enrichment, low dissolved oxygen
Lake Bray, Holyoke	Noxious aquatic plants
Forge Pond, Granby	Nutrients, noxious aquatic plants
Ingraham Brook Pond, Granby	Noxious aquatic plants
Leverett Pond, Leverett	Noxious aquatic plants, turbidity
Loon Pond, Springfield	Nutrients, noxious aquatic plants
Venture Pond, Springfield	Nutrients, noxious aquatic plants, organic enrichment, low dissolved oxygen, turbidity
Watershops Pond, Springfield	Noxious aquatic plants
Nashawannuck Pond, Easthampton	Nutrients, organic enrichment, low dissolved oxygen, Noxious aquatic plants
Lake Wyola, Shutesbury	Nutrients, organic enrichment, low dissolved oxygen, Noxious aquatic plants
Lake Warner, Hadley	Nutrients, organic enrichment, low dissolved oxygen, Noxious aquatic plants
River Segments	
Connecticut River: NH line to Northfield	Priority Organics (PCBs), pathogens (fecal coliform bacteria)
Connecticut River: Northfield to Turners Falls Dam	Priority Organics (PCBs)
Connecticut River: Turners Falls Dam to Deerfield River	Priority Organics (PCBs)
Connecticut River: Deerfield River to Holyoke Dam	Priority Organics (PCBs), pathogens (fecal coliform bacteria)
Connecticut River: Holyoke Dam to CT line	Priority Organics (PCBs), pathogens (fecal coliform bacteria), suspended solids
Weston Brook: Headwaters, Belchertown State Hospital to Weston Brook	Unionized ammonia, chlorine, nutrients, organic enrichment, low dissolved oxygen, pathogens
Lampson Brook: Belchertown State Hospital to Weston Brook	Unionized ammonia, chlorine, nutrients, organic enrichment, low dissolved oxygen

Source: Mass. Department of Environmental Protection, 1998

2.3 WATER QUALITY ASSESSMENT BY SEGMENT

2.30 Stream Segment Assessments

The Connecticut River 1998 Water Quality Assessment Report, prepared by Mass. Department of Environmental Protection, provides an assessment of whether or not designated uses are being met for each stream segment in the Connecticut River basin (support, partial support, non-support). The report assesses the following designated uses:

- Aquatic life use
- Fish consumption use
- Primary contact recreational use
- Secondary contact recreational use
- Aesthetics use

The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which surface waters in the state shall be protected. Detailed information for 32 individual river segments and 47 lakes in the Connecticut River basin is presented for each designated use. Table Five (below) contains a summary of all use designation support by stream segment. The report also includes basic information needed to focus resource protection and remediation activities later in the watershed management process.

2.31 Aquatic Life Use

The Aquatic Life Use is supported when suitable habitat (including water quality) is available for sustaining a native, naturally diverse, community of aquatic flora and fauna. The Aquatic Life Use was supported in 53.1 river miles, including:

- the entire length of the Mill River in Hatfield,
- the Connecticut River from the Deerfield River confluence to the Holyoke Dam.

The Aquatic Life Use is partially supported in 15.1 river miles, including:

- the Connecticut River, from the NH/VT state line to the Turners Falls Dam.The Aquatic Life Use is not supported on 2.3 river miles:
- the Connecticut River below the Turners Falls Dam (where the river is rendered virtually dry during portions of the year, due to diversions to Northeast Utilities' power canal).

The Aquatic Life Use was not assessed on 167.4 river miles.

The DEP report recommends that the effects of hydromodification resulting from the operations of FERC licensees should be minimized to the extent possible since they are known to contribute to streambank erosion although other factors (recreation, agricultural activities, natural) also contribute to erosion. Streambank stabilization projects have been initiated in selected areas, however it is too early to evaluate their long-term success.

2.32 Fish Consumption Use

The Fish Consumption Use is supported when there are no pollutants present that result in unacceptable concentrations in edible portions of marketable fish or shellfish or for the recreational use of fish, shellfish, other aquatic life or wildlife for human consumption. The assessment of this use is made using the most recent list (1999) of Fish Consumption Advisories issued by the Mass. Department of Public Health.
The Fish Consumption Use is not supported on 67.5 river miles:

- the Connecticut River's entire length in Massachusetts (due to fish consumption advisory for PCBs).

The Fish Consumption Use was not assessed on 170.4 river miles.

The DEP report finds that data used for the fish consumption advisory are now approximately ten years old, and that questions about current contamination levels cannot be answered.

2.33 Recreational Use

The Primary Contact Recreational Use is supported when conditions are suitable (low fecal coliform bacteria densities) for any recreation or other water activity during which there is prolonged or intimate contact with the water with a significant risk of inegestion. Activities include, but are not limited to, wading, swimming, diving, surfing, and water skiing.

The Secondary Contact Recreational Use is supported when conditions are suitable for any recreation or other water use during which contact with water is either incidental or accidental. These include, but are not limited to, fishing, boating, and limited contact incident to shoreline activities.

The Primary Contact Recreational Use is not supported, and the Secondary Contact Recreational Use is partially supported, in 15.9 river miles, including:

- the Connecticut River, from the Holyoke Dam to the CT state line.

The Primary and Secondary Contact Recreational Use were not assessed on 222 river miles.

The DEP report finds that three major CSO permittees, Springfield, Chicopee and Holyoke, are in the process of CSO facilities planning to develop a water quality modeling project and long-term control plans for abatement of CSOs.

2.34 Aesthetics Use

The Aesthetics Use is supported when surface waters are free from pollutants in concentrations or combinations that settle to form objectionable deposits, float as debris, scum or other matter to form nuisances, produce objectionable odor, color, taste, or turbidity, or produce undesirable or nuisance species of aquatic life.

The Aesthetics Use was supported in 24.6 river miles, including:
- the entire length of the Mill River in Hatfield,

The Aquatic Life Use was not assessed on 213.3 river miles.

2.35 Summary from DEP Connecticut River Basin Assessment Report

In summary, the DEP report recommended the need for the following:
- Additional monitoring (i.e. fecal coliform bacteria and impact evaluations of thermal discharges);
- Implementation of CSO abatement;
- Minimize streamflow fluctuations to reduce "anthropogenically" induced erosion resulting from hydropower facility operations;
- Post-implementation monitoring to assess the effectiveness of streambank stabilization projects.
- Continue to improve minimum flow releases into the "by-passed" reach of the Connecticut River at Turners Falls Dam.

Re-issued NPDES permits will place emphasis on CSO control, compliance with secondary treatment requirements and an evaluation of nutrient loading. Many municipalities will be required to obtain Phase 2 storm water permit to reduce impacts of strom water to the river by the development of Best Management Practices, elimination of cross connections and through public education.

The DEP report also notes that 49% of the lakes (23 of 47 lakes) in the Connecticut River basin showed severe (eutrophic or hypereutrophic) symptoms of succession. The following lakes related needs were noted:
- Additional monitoring;
- Continue to control the spread and growth of non-native aquatic vegetation;
- Continue to implement the recommendations of from lake Diagnostic/Feasibility studies.

Table Five. Summary of Stream Segment Use Support

STREAM SEGMENT	AQUATIC LIFE	FISH CONSUMPTION	PRIMARY CONTACT	SECONDARY CONTACT	AESTHETICS
Connecticut River, NH/VT State line to Northfield	Status: Partial Support Causes: Flow alteration, habitat alteration Sources: Hydromodification and habitat modification	Status: Non Support Causes: PCB contamination Sources: Unknown	Status: Not Assessed	Status: Not Assessed	Status: Not Assessed
Connecticut River, Northfield to Turners Falls Dam	Status: Partial Support Causes: Flow alteration, habitat alteration Sources: Hydromodification and habitat modification	Status: Non Support Causes: PCB contamination Sources: Unknown	Status: Not Assessed	Status: Not Assessed	Status: Not Assessed

Table Five. Summary of Stream Segment Use Support (cont'd)

STREAM SEGMENT	AQUATIC LIFE	FISH CONSUMPTION	PRIMARY CONTACT	SECONDARY CONTACT	AESTHETICS
Connecticut River, Turners Falls Dam to Deerfield River	Status: Non Support (upper 2.3 miles): Partial Support (lower .7 miles) Causes: Flow alteration, unknown suspended solids Sources: Hydromodification and unknown	Status: Non Support Causes: PCB contamination Sources: Unknown	Status: Not Assessed	Status: Not Assessed	Status: Not Assessed
Connecticut River, Deerfield River to Holyoke Dam	Status: Support (upper 28.5 miles) Not Assessed (lower 5.7 miles) Causes: Sources	Status: Non Support Causes: PCB contamination Unknown	Status: Not Assessed	Status: Not Assessed	Status: Not Assessed
Connecticut River, Holyoke Dam to CT state line	Status: Not Assessed	Status: Non Support Causes: PCB contamination Sources: Unknown	Status: Non Support Causes: Pathogens Sources: CSOs, urban runoff/storm sewers, unknown	Statys: Partial Support Causes: Pathogens Sources: CSOs, urban runoff/storm sewers, unknown	Status: Not Assessed
Mill River, Hatfield	Status: Support	Status: Not Assessed	Status: Not Assessed	Status: Not Assessed	Status: Not Support
26 other river or stream segment	Current data not available and therefore all uses not assessed				

Source: Connecticut River Basin 1998 Water Quality Assessment Report, Mass. Department of Environmental Protection, 1998

2.4 PRIORITY WATER QUALITY ISSUES

2.40 Combined Sewer Overflows

While the Connecticut River has made impressive gains in the past 15 years, a major hurdle to achieving clean water in the lower reach of the river remains. In 1988, below the Holyoke Dam, 134 combined sewer overflows were identified, 31 of which discharged in dry weather *(Lower Connecticut River Phase II Combined Sewer Overflow Study, Metcalf & Eddy, for MA Division of Water Pollution Control, March 1988)*. The result was that neither the Connecticut River nor its key tributaries, the lower portions of theWestfield and Chicopee Rivers, were safe for fishing or swimming, even during dry weather, as of 1988. In 1988, Metcalf & Eddy completed a $1 million, detailed engineering study (referenced above) for the Massachusetts Division of Water Pollution Control (DWPC) to address this problem. Water quality monitoring conducted for the study indicated "bacterial pollution and aesthetic impacts due to sewage solids and floatables, but no significant impacts on dissolved oxygen". The DWPC study provided recommendations for separating sewer lines and building screening and disinfection facilities at an estimated cost of $377 million.

In March 1997, the U.S. Environmental Protection Agency issued Administrative Orders to Springfield, Chicopee, Holyoke, West Springfield, Agawam, South Hadley and Ludlow to eliminate their CSOs. Connecticut River communities have responded to EPA administrative orders with ambitious projects for updating their facilities plans - Holyoke's at a cost of $500,000 and Springfield's at $750,000 - and by accelerating the pace of needed CSO abatement projects (Agawam, South Hadley, and Chicopee).

In the thirteen years since the DWPC study was completed, communities have made some progress on CSOs. Using primarily local funds and community development block grants, the seven communities have eliminated 56 of the original 134 CSOs, and 28 of the original Dry Weather Overflows, as shown below:

While this progress is significant and hopeful, it should be noted that most of the CSOs eliminated to date were smaller in size and cost. The largest volume, and most costly, CSOs remain intact, along with their impact on the river. Eliminating these CSOs is estimated to be significantly more costly than the $377 million price tag (adjusted to 1993 dollars) identified in the 1988 Metcalf and Eddy study. The primary problems in making progress on these larger CSOs have been:

- A lack of community applications for State Revolving Fund loan monies;
- a lack of federal and state grant funding to assist communities;
- some communities have not completed long-term CSO control plans that would form the basis for construction funding.

In 1999, the Pioneer Valley Planning Commission and the Interstate Coalition for Connecticut River Clean-up launched an interstate campaign to seek a federal budget line item to provide funding for clean up of CSOs. With the assistance of Congressmen John Olver and Richard Neal, and Senators Edward Kennedy and John Kerry, with legislators from the state of Connecticut, a total of $1.305 million was appropriated for this purpose in federal Fiscal Year 1999, divided between Massachusetts and Connecticut communities. In Massachusetts, the funding supported six different CSO elimination or reduction projects. In the program's second year, FY2000, federal funding appropriation was increased to $1.425 million. Additional federal funds will be sought in subsequent years to continue this effort.

There is one CSO in the Franklin County reach, but the town of Montague is working to correct it.

Table Six. Status of Combined Sewer Overflow Clean-up

COMMUNITY	Number of CSOs in 1988	Number of Dry Weather Overflows 1988	Number of CSOs in 2001	Number of Dry Weather Overflows in 2001
Agawam	14	4	0	0
Chicopee	39	19	33	2
Holyoke	20	1	15	1
Ludlow	10	0	1	0
South Hadley	11	2	3	0
Springfield	32	5	25	0
West Springfield	8	0	1	0
TOTAL	134	31	78	3

Source, 1988 CSOs: based on Metcalf and Eddy Study
Source, 2001 CSOs: Interviews with municipal Public Works Superintendents

2.41 Streambank Erosion

The most significant water quality problem in the northern reach of the river is excessive sediment due to severe streambank erosion. There are a number of practices that contribute to increased streambank erosion. The size and placement of culverts and bridges, land conversion, increase in impervious surfaces, loss of vegetation on streambanks, soil disturbance or compaction, and inappropriate logging and agricultural practices within the floodplain or watershed, result in a change in water flow overland and in the stream. This may greatly increase erosion of the streambanks and/or deposition of sediment in areas that will create a loss of habitat and habitat functionality. Altered streambanks and streams are compromised by increased turbidity, contaminants, and changes in depth and temperature which reduces their ability to function optimally. This in turn negatively affects fish and other water dwelling creatures, as well as other wildlife, and can also impact human health and safety through flooding of roads and buildings, and possible contamination of surface and groundwater drinking water supplies.

State agencies and watershed groups from Vermont and New Hampshire through Massachusetts and Connecticut have identified streambank erosion along the Connecticut River as a serious problem. It is especially critical in the Turners Falls Power Pool, extending from

Turners Falls MA to the VT/NH border. Severe erosion is increasing nonpoint source pollution in an important anadromous and freshwater fisheries habitat. It is also contributing to the loss of prime agricultural soils and cropland, and the woody riparian buffer habitat used by migratory birds, eagles, and other wildlife. Some areas are estimated to have receded landward by as much as 50 feet since 1979.

In a 1991 study, the Army Corps of Engineers revealed that riverbank erosion along the Turner's Falls pool has increased threefold since 1979, with approximately one-third of the 148,000 feet of shoreline undergoing some form of active erosion *(General Investigation Study, Connecticut River Streambank Erosion, Turners Falls Dam to State Line, MA (New England Division: US Army Corps of Engineers, 1991)*. A summary of soil loss from nine monitoring cross sections on 22,987 linear feet of the upper reach of the Connecticut River estimated a total of 281,281 tons of soil for the time period 1990-1996 (Connecticut River Watershed Restoration 319 Project Final Report (Franklin Regional Council of Governments, 1999). A 1998 Erosion Control Plan for the Turners Falls Pool, produced for the Western Massachusetts Electric Company (WMECO), identified 20 severely eroding sites, totaling 15,397 linear feet, as high priority sites for repair in the next four years *(Erosion Control Plan for the Turners Falls Pool of the Connecticut River (Simons & Associates, September 1998)*.

An erosion control project has been initiated on five highly eroding sites by Northeast Utilities, the owner and operator of the two hydroelectric power facilities affecting water levels in the Turners Falls Pool (the Turners Falls and Northfield Mountain plants), advised by the Connecticut River Streambank Erosion Committee. These riverbanks are being treated with a combination of hard (riprap) and soft (living and plant material) erosion control methods. Similar work is expected to continue in the Turners Falls Pool at least until the expiration of the projects' FERC licenses in 2018.

2.42 PCBs

Pollution from PCBs (polychlorinated biphenyls) is the reason that the entire length of the Connecticut River in Massachusetts does not meet water quality standards, due to non-support of fish consumption as a designated use. The Mass. Department of Public Health issued a fish consumption advisory for the Connecticut River (all towns between Northfield and Longmeadow) recommending that "children younger that 12 years, pregnant women and nursing mothers should not eat any fish from the Connecticut River and the general public should not consume channel catfish, white catfish, American eel or yellow perch because of elevated levels of PCB".

The suspected source of PCBs in the Connecticut River is a paper plant on the Millers River. DEP and the Millers River Basin Team are participating in an ongoing investigation of the PCBs in the Millers River and adjacent lands. Data used to issue the PCB fish consumption advisory for the Connecticut River are now over ten years old, and it is not know if the problem has worsened or improved. The New England Interstate Water Pollution Control Commission and U. S. Environmental protection Agency initiated fish tissue sampling program in 2000 to help address this issue.

2.43 Summary of Water Quality Priorities

Based on a summary recent Connecticut River reports, the following are the most significant Connecticut River water quality issues:

- Combined sewer overflows -81 CSOs in six communities release bacteria and solids into the river, resulting in water quality violations and interstate impacts;
- PCBs in fish - elevated levels of PCBs result in public health advisories for fish consumption and water quality violations throughout the entire length of the Connecticut River in Massachusetts;
- non-point source pollution - urban runoff results in violations of water quality standards for pathogens and suspended solids, and agricultural runoff results in turbidity, nutrients, pathogens and pesticide pollutants;
- flow conditions at hydropower projects - changing flow conditions result in excessive levels of erosion and turbidity in the upper river and adverse impacts on fisheries; and
- Severe bank erosion in the northern reach of the river.

2.5 STRATEGIES FOR WATER QUALITY AND QUANTITY

Strategy #1 (Water Quality): Adopt a Comprehensive CSO Control Program

Implementation of a reasonable combined sewer overflow program, including innovative funding mechanisms and federal assistance to defray local costs is needed in order to bring the Connecticut River into compliance with the Clean Water Act and EPA Administrative Orders. Without federal or state assistance, the estimated $421 million (1998 dollars) cost of CSO abatement would raise Chicopee's sewer rates 400% and Holyoke's rates 120%. The Boston Harbor clean-up has received most of the federal grant resources available for water quality clean-up in Massachusetts totaling $635 million in grant and loan funds, including $50 to $100 million annually in grant funds since 1991. By contrast,

western Massachusetts's communities received no grant funds, until 1999. A key impediment has been that the communities have not completed plans that would form the basis for construction funding. It is now important that the communities complete preparation of CSO plans, and make application for SRF and other funds.

Recommended Actions:

1) **Seek Congressional action to continue and increase funding appropriations in the federal budget for Connecticut River CSO cleanup.**
Funding is provided in the Environmental Protection Agency portion of the HUD/VA budget. A total of $1.305 million in federal funds were provided in FY99 for both MA and CT; and an additional $1.425 million was provided in FY2000. Funding is provided to western Massachusetts communities via an EPA grant to the Pioneer Valley Planning Commission. The Connecticut River Clean-up Committee will continue to seek continued and increased funding in subsequent years. Funds are in the EPA budget, available as 55% grants.

2) **Encourage municipalities to apply for more low-interest SRF loans for CSO projects, and seek state legislative support to return to a 0% interest rate on SRF loans.**
Connecticut River CSO communities have not fared as well as Boston area communities in securing SRF loans for wastewater projects. This is most likely due to a combination of factors, including the relatively low level of SRF applications from Connecticut River communities; and SRF criteria and funding processes, including an increase in interest rates from 0% to 2%. The SRF is the best capitalized funding option for the large-scale CSO projects which are needed in Springfield, Chicopee and Holyoke. It is important for these communities to apply annually for SRF projects.

   The Connecticut River Clean-up Committee and other interested groups should also seek the support of area legislators to amend the SRF and return it from the current 2% interest rate to a 0% interest rate.

3) **Seek EPA support for Connecticut River CSO Clean-up Initiatives under American Heritage Rivers designation.**
Request EPA assistance in securing funding for innovative, watershed-based CSO correction projects, such as the proposed Chicopee constructed wetland project.

4) **Develop state enabling legislation for stormwater utilities, to create significant new revenue stream to fund CSO clean up needs, and encourage communities to create such utilities using "stormwater utility kit".**
Assist key CSO communities to adopt stormwater utilities. In 1999, the City of Chicopee created a stormwater fee, which has resulted in annual assessments totaling approximately $500,000 that can be used for CSO correction. PVPC has created a detailed kit for communities "How to Create a Stormwater Utility". Other communities should follow this model. Stormwater utilities collect fees from property owners, based on the amount of paved area on their property. Fees can then be used for correcting CSO and stormwater problems.

5) **Support cooperative efforts between communities, EPA and DEP for watershed oriented projects to address CSOs.**
As opposed to focusing entirely on costly "end-of-pipe", "bricks and mortar" solutions to CSOs such as sewer separation, some resources should be used for lower cost, watershed-based solutions for preventing urban runoff from entering the combined sewer system. For example, watershed approaches could include retrofitting existing development with stormwater BMPs and removing unnecessary paved surfaces to reduce runoff.

6) **Support reauthorization of the federal Clean Water Act, including creation of new grant programs to address innovative CSO solutions.**
Congress should authorize significant new grant funding to develop cost-effective CSO control measures.

   The recent passage of the Wet Weather Water Quality Act of 2000 addressed this issue, at least in part, through the creation of two new grant programs for:
   - Section 121 watershed pilot programs to fund treatment works to control CSOs, SSOs and storm water discharges on an integrated watershed basis;
   - Section 221 for sewer overflow control grants. The Connecticut River Clean-up Committee should pursue projects under this new program.

Strategy #2 (Water Quality): Develop a Consistent Water Quality Monitoring Program

Design a comprehensive, watershed-based water quality monitoring program to provide improved and updated data to better understand and address the Connecticut River's water quality problems. Water quality monitoring on tributaries should be standardized and expanded as well.

Recommended Actions:

7) **Set up a multi-organization consortium to establish an ongoing regional water quality sampling and monitoring program for the Connecticut River and its tributaries.**

   A regional water quality sampling program and assessment model will be undertaken during 2001-02 by the Springfield Sewer and Water Commission, in cooperation with Chicopee, Holyoke and PVPC. This program is funded under a grant to PVPC via the federal budget earmark for Connecticut River Clean-up. River monitoring of fecal coliform will be conducted at 12 in-stream locations and five storm drain locations on the Connecticut and Chicopee Rivers from the Holyoke Dam to the Westfield River confluence area during two wet weather and one dry weather event. A water quality model will be used to assess receiving water impacts from one mile north of the Holyoke Dam to the MA/CT state line. This survey and model will be a useful basis for further ongoing river water quality monitoring.

   The "Swimming Hole" Project, conducted by the Massachusetts Water Watch Partnership in 1998, trained volunteers to monitor bi-weekly for fecal coliform at selected recreational sites on the mainstem of the river. This project should be continued, with modifications, and expanded to include other current and potential "swimming holes" in the watershed.

   A consortium of organizations, including DEP, PVPC, CRWC, EPA, MWWP, and community public works officials, have begun meeting, with the goal of establishing and finding funding to establish an ongoing regional water quality sampling and monitoring program for the Connecticut River. The consortium will seek federal funding and other sources of support. The Charles River Watershed Association has been successful in establishing and funding such a program, with results posted regularly on the Internet.

8) **Encourage DEP and volunteer monitors to work together to establish a cooperative, ongoing river sampling program in the Connecticut River and its tributaries.**

9) **Undertake a pilot study sampling of a tributary watershed.**
   Water quality monitoring could identify tributary stream reaches with particularly high water quality, which should lead to action to safeguard those stream reaches from degradation through regulations and land acquisition.

10) **Identify grants or resources to establish water quality and sediment sampling and monitoring program in hot spot areas, such as PCBs in sediments, and coal tar sites.**

Strategy #3 (Water Quality): Reduce urban, suburban runoff, and rural non-point source pollution.

Recommended Actions:

11) **Implement improved street sweeping programs in every community to reduce pollutants in stormwater.**
   Conventional street sweeping with brushes removes only the sand and coarse silt portion of the pollutant, leaving behind the more noxious fine dust and dirt fraction of clay and silt size particles which harbor the bulk of the pollutants.The use of vacuum sweepers in other cities indicates that vacuum sweepers have three times the capacity, one quarter of the operation and maintenance costs, and less downtime than brush sweepers.

12) **Institute stormwater and other non-point source pollution controls in new development and redevelopment projects.**
   DEP has two publications that should be consulted for practices that improve the management of stormwater and reduce pollution. These are:
   - *Nonpoint Source Management Manual: "The Megamanual"; and*
   - *Stormwater Management, Volume One: Stormwater Policy Handbook, and Volume Two: Stormwater Technical Handbook.*

   New USEPA Phase II Stormwater Regulations require communities with municipal separate storm sewer systems (MS4s) within urbanized areas having a population over 10,000 to obtain an NPDES permit. These regulations will apply to many communities in the watershed, and steps like #10, #11 and #13 will help communities meet the new federal requirements.

13) **Identify demonstration sites for innovative stormwater best management practices.**
   Innovative practices such as green parking lots, wetland treatment systems, and infiltration devices have been incorporated in development in other states. These practices should be tested with new development in the Connecticut River watershed. Such projects are also eligible for federal funding under Section 319 of the federal Clean Water Act.

14) **Pass local stormwater ordinances/bylaws that require all developments to comply with the DEP stormwater standards.**
The current DEP Stormwater Policy applies only to developments within wetland/riverfront resource areas. Communities can and should adopt local regulations which will make all development subject to the stormwater policy.

15) **Increase boat pump-out stations on the mainstem.**
Pumpout stations are needed in locations where boats with on-board toilets are used (marinas, boat clubs, etc.).

16) **Promote efforts to direct TEA-21 Enhancement funds and other funds to remediate existing priority stormwater discharges from road runoff.**
The enhancements program of the Federal High way program provides funding to projects under the category of road runoff. While money for the program is currently (1999) difficult to obtain, it may be that funding will become more available in future years. A local match of 10 percent and a state match of 20 percent is required for any projects. If communities are prepared to provide a match of 30 percent or more, federal money might be easier to maintain.

17) **Reduce pollutants in agricultural runoff.**
Create partnerships with large farmland owners to apply for grants and implement best management practices.

Agricultural BMPs listed in the *"Megamanual"* include management practices (nutrient management, integrated pest management, proper pesticide use, irrigation water mgt.) vegetative tillage practices (contour farming, crop rotation, etc.), and structural practices (grassed waterways, waste management structures, wetland development, etc.).

Continue programs funded by the Conservation Districts and the Department of Food and Agriculture to reduce pollutant inputs to surface waters.

Promote participation in the WHIP (NRCS) and other programs for fencing livestock out of streams.

Promote organic farming as a way to reduce pesticide sources.

18) **Clean up old riverbank dumping sites**
Riverbank dumping sites are common along the Connecticut River banks, both in rural areas where agricultural equipment, oil drums and tires lie discarded, and in urban areas where banks have in some cases been filled in with solid wastes.

19) **Investigate and eliminate piped, point source drainage discharges to the river in rural areas.**

20) **Support timely development of TMDLs (Total Maximum Daily Loads) as a priority activity to help impaired waters meet Massachusetts Water Quality Standards.**
TMDLs were required to be developed as part of the Clean Water Act twenty years ago. In the development of TMDLs, the loading capacity of a water body is determined, then that capacity is divided between the point and nonpoint source of pollution discharging to the body. In 1996, regulations placed responsibility with states to develop TMDLs with Implementation Plans for non-compliant water bodies (303d listed) over a ten year period. To date, DEP has developed 81 TMDLs, mostly in coastal areas, lakes and ponds, but Massachusetts has 1500 segments on the 303d list. The development of TMDLs for the Connecticut River would be an effective tool for achieving cleaner water.

21) **Support urban and community programs (including tree planting efforts) that result in increased canopy cover and improved urban forest health for improved watershed health.**
Healthy trees provide numerous benefits to communities and to watershed health including reducing temperatures, reducing stormwater runoff, filtering airborne and waterborne pollutants, providing wildlife habitat, and stabilizing soils. Indeed, an increase in forest canopy cover of 50% can reduce stormwater flows by as much as 30%. Communities in the Connecticut River watershed should work to improve the health of public and private trees and forests and should encourage additional planting of street, park, and riparian trees, particularly along riparian areas. DEM's Urban and Community Forestry Program works with communities to strengthen town forestry programs, build local tree boards, and improve the management of town trees and forests.

Strategy #4 (Water Quality): Reduce soil erosion and sedimentation throughout the watershed.

Recommended Actions:

22) **Identify and map severe erosion sites in the watershed.**
Inventories of severely eroding sites on the upper reach (Turners Falls Pool) of the river have been done periodically since 1979, and a new Erosion

Control Plan has recently been submitted by Northeast Utilities prioritizing restoration sites for the next five years. The Connecticut River Watershed Council is also beginning an inventory of eroding streambanks on the CT River throughout the mainstem.

23) **Seek funding from the state in cooperation with NRCS and the utilities to continue bioengineering streambank restoration efforts.**

24) **Assist communities with the adoption of erosion and sediment control bylaws.**
Two publications produced by MA DEP provide information about erosion control and should be consulted in the development of local regulations, including: *Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas,* 1997; and *Nonpoint Source Management Manual, The "Megamanual".*

25) **Encourage stream bank restoration projects similar to the bioengineering projects being undertaken on the mainstem and on the Mill River in Whately**
A DEP 319 grant to the FRCOG in 1996 introduced bioengineering techniques for restoration of stream banks at three priority sites in the northern reach, in cooperation with Western Massachusetts Electric Company, a division of Northeast Utilities. The conventional approach to solving a severe erosion problem has been the use of riprap, gabions, and other hard materials. These methods are unsightly, expensive, and lack the habitat value of the native vegetation they replace and are trying to protect. "Soft" solutions such as bioengineering, which utilizes native vegetation and natural materials to stabilize eroding sites, are preferred for environmental and practical reasons. In addition, bioengineered sites require less maintenance and have a better chance of withstanding severe conditions. A useful reference is *Western Massachusetts Streambank Erosion Guide* by Gene Mills.

Strategy #5 (Water Quality): Reduce toxins in fish tissue.

As of May, 2001, the Massachusetts Board of Public Health had a fish consumption advisory for the mainstem of Connecticut River from Northfield to Longmeadow (although this does not apply to tributary streams). Channel Catfish, White Catfish, American Eel, and Yellow Perch caught in the river should not be eaten by anyone. Pregnant women, nursing mothers, and children under twelve should not eat any fish from the river. This advisory does not apply to stocked fish, which have a short residence time in the river. The advisory has been issued because of contamination by PCBs.

Recommended Actions:

26) **Undertake a program of PCB Investigation and remediation.**
Monitor and investigate the source of contamination, inventory and mapping of sediments, with continued public health advisories and remediation as necessary. The Millers River watershed team, working with federal and state agencies, is investi gating the PCB problem on the Millers River and should be consulted as an example for the Connecticut River Basin Team.

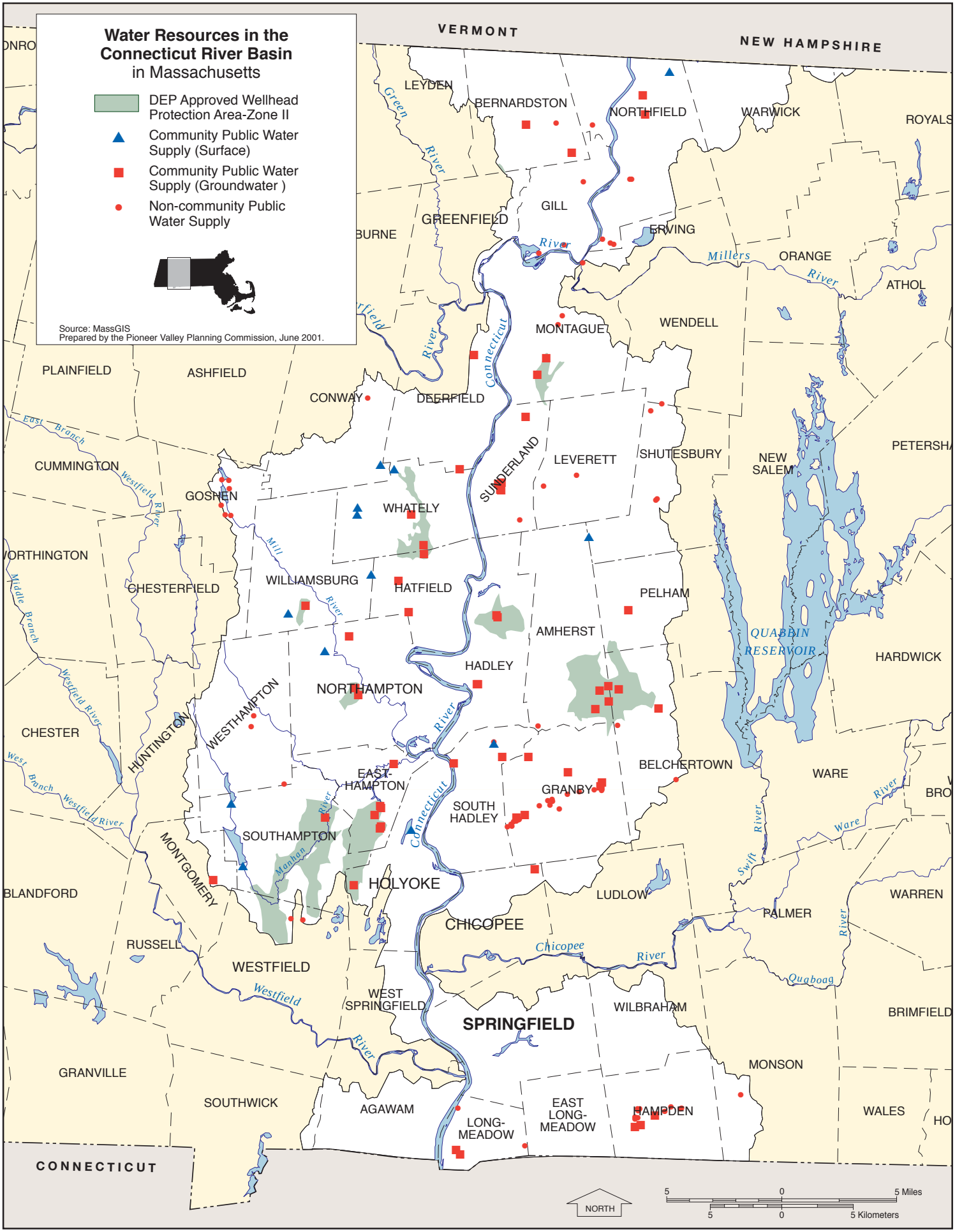
27) **Increase public awareness of public health fish advisories by posting better signage and advisories in fishing and recreation areas.**
Better signage at fishing access points is needed to inform the public of the DPH advisory. Public health fish advisories should be accompanied by information to tell the public "what they can do" to help prevent pollution and improve fish quality. It would also be helpful to conduct a public health survey to determine the level of fish consumption in the watershed.

Strategy #6 (Water Quality and Quantity): Promote water conservation and efficient delivery systems.

By reducing water consumption by existing residents and businesses and through improving water delivery systems, water suppliers can reduce or eliminate the need for additional water withdrawals. In addition, reduced water withdrawals leave more water in streams for assimilating and diluting pollution. In the early 90s, for example, the town of Amherst, MA was faced with a water supply shortage and the prospect of developing a new supply well at a cost of almost two million dollars. DPW officials elected to try a number of water conservation efforts including retrofitting apartment complexes with low flow devices and carefully regulating new development. Projected increases in water consumption by the community were reduced, thereby avoiding the need to develop a new well.

Recommended Actions:

28) **Promote water conservation efforts in local communities.**
- Adopt conservation-oriented water rate structures and pricing policies.
- Enforce and improve the State Plumbing Code.
- Promote the retrofit of domestic water conserving devices.


Water Resources in the Connecticut River Basin in Massachusetts
DEP Approved Wellhead Protection Area-Zone II
Community Public Water Supply (Surface)
Community Public Water Supply (Groundwater)
Non-community Public Water Supply
Source: MassGIS
Prepared by the Pioneer Valley Planning Commission, June 2001.
VERMONT
NEW HAMPSHIRE
CONNECTICUT
LEYDEN
BERNARDSTON
NORTHFIELD
WARWICK
ROYALS
GREENFIELD
GILL
ERVING
ORANGE
ATHOL
MONTAGUE
WENDELL
PLAINFIELD
ASHFIELD
CONWAY
DEERFIELD
SUNDERLAND
LEVERETT
SHUTESBURY
NEW SALEM
PETERSHA
CUMMINGTON
GOSHEN
WHATELY
WILLIAMSBURG
HATFIELD
PELHAM
AMHERST
QUABBIN RESERVOIR
HARDWICK
HADLEY
NORTHAMPTON
CHESTERFIELD
CHESTER
HUNTINGTON
WESTHAMPTON
EAST HAMPTON
SOUTH HADLEY
GRANBY
BELCHERTOWN
WARE
SOUTHAMPTON
MONTGOMERY
HOLYOKE
LUDLOW
PALMER
WARREN
BLANDFORD
CHICOPEE
RUSSELL
WESTFIELD
WEST SPRINGFIELD
SPRINGFIELD
WILBRAHAM
BRIMFIELD
MONSON
GRANVILLE
SOUTHWICK
AGAWAM
LONG-MEADOW
EAST LONG-MEADOW
HAMPDEN
WALES
Connecticut River
Millers River
Deerfield River
Green River
Mill River
Middle Branch Westfield River
East Branch Westfield River
West Branch Westfield River
Westfield River
Manhan River
Chicopee River
Swift River
Ware River
Quaboag River
NORTH
5 0 5 Miles
5 0 5 Kilometers

- Adopt new construction guidelines and zoning regulations to include recycling of cooling water, xeriscaping, and cluster development.
- Undertake public drinking water education programs.

- Retrofit municipal buildings with water conserving devices.

- Discourage non-essential consumptive uses such as lawn watering.

Note: See the *Pioneer Valley Water Action Plan* (PVPC, June, 1990) for recommended community water conservation practices.

Strategy #7 ***(Water Quality): Protect watershed and aquifer recharge lands to prevent it from being developed or contaminated.***

Recommended Actions:

29) **Provide technical assistance to water suppliers in efforts to acquire watershed or aquifer recharge lands, including working with property owners and identifying funding sources.**
As a successful example of land acquisition efforts to protect a public water supply, the Town of Hatfield has used Forest Legacy funding to acquire 212 acres of land from five landowners in the Running Gutter Brook Reservoir watershed. South Hadley has acquired over 140 acres using the same funding source.

30) **Minimize herbicide spraying along highways, utility corridors, and other right-of-way, especially within 100 feet of wetlands, rivers, and other surface waters.**

3.0 PRESERVATION OF STREAMS AND WILDLIFE HABITAT

3.1 PUBLIC RESPONSE AND PARTICIPATION

PRIORITY STREAM PRESERVATION GOALS

Based on a Watershed Survey of civic leaders in all Massachusetts communities in the Connecticut River main stem watershed, the most important goals for stream and wildlife habitat preservation for the Connecticut River are (ranked in order of priority):

1) **increase public recognition and protection of important wildlife habitat in river areas;**
2) **identify and safeguard terrestrial and aquatic wildlife habitats;**
3) **preserve and restore vegetated riparian buffers;**
4) **control, reduce and prevent the introduction of non-native, invasive species;**
5) **ensure adequate fish passage in the river and tributaries;**
6) restore river connectivity by removing barriers to wildlife passage;
7) require the establishment of minimum stream flows needed for aquatic life;
8) promote grassroots awareness and involvement in stream management, such as encouraging the establishment of "stream teams" (groups of citizens working together to inventory, monitor and protect streams);
9) limit water withdrawals to protect aquatic health.

PRIORITY STREAM PRESERVATION PROBLEMS

The most significant problems related to preservation of streams and wildlife habitat identified by civic leaders are as follows (ranked in order of priority):

1) **loss of riparian buffer areas and wildlife habitat along streams;**
2) **introduction of non-native, invasive species to riverine areas;**
3) **physical barriers (dams, culverts, bridges, and other structures) block river connectivity;**
4) lack of fish passage facilities at dams and fish access to spawning areas;
5) ecosystem degradation due to water withdrawals at public reservoirs and other withdrawal points.

Based on the "Connecticut River Watershed Public Brainstorming Session" held 11-14-98 in Hadley, MA, the following issues were identified as top priority stream preservation and wildlife habitat concerns for residents of the watershed:

1) Restore vegetated riparian buffers, with a focus on headwaters and lower order streams. Suggested actions included:
   - develop and present workshops and a handbook for a variety of audiences;
   - promote agricultural best management practices;
   - investigate funding options for purchasing and retiring sensitive riparian farmlands;
   - remove impervious surfaces within 50 feet of streams;
   - investigate and pursue functional replacements for impervious surfaces within 100 feet of streams.
2) Restore river connectivity. Suggested actions included:
   - develop strategies for removal of barriers to connectivity, including identifying and mapping barriers, assessing impacts of barriers, prioritizing barriers for removal or mitigation, and identifying opportunities for dam removal;
   - upgrade driveway, roadway, highway and railroad stream crossings to promote greater fish and wildlife passage, including developing standards for culverts and bridges to allow fish and wildlife passage, assessing and prioritizing most significant problem areas, and seeking commitments from Mass. Highway Department and local public works

departments to set annual goals for upgrading stream crossings;
- seek a regulatory requirement that Mass. Highway Department evaluate and address barrier issues as part of road upgrade or reconstruction projects;
- improve state highway planning, including adoption of culvert standards for fish and wildlife passage;
- review road or culvert projects under the MEPA process and offer technical assistance;
- develop and conduct educational programs on the value of, and issues related to, stream connectivity.

3) Restore river hydrology. The following actions were suggested:
   - identify locations of water withdrawal points;
   - determine health of streams below withdrawal points;

- make modifications to pumping locations and/or regimes to reduce adverse impacts;
- help water suppliers improve efficiency of their water delivery systems.

4) Upgrade stormwater systems and CSOs. Suggested actions included:
   - identify water bodies, such as small streams and tributaries to water supply reservoirs, where such upgrades would be meaningful;
   - secure funds, such as Section 319 funds, to implement stormwater Best Management Practices.
5) Promote public education on the need for protection and restoration of special habitats;
6) Involve schools in habitat restoration projects;
7) Encourage farmers to keep livestock away from water sources, and reduce herbicide/pesticide use through tax credits.

3.2 ASSESSMENT OF THE CURRENT SITUATION

Riverine systems, streams and rivers as well as their associated riparian areas, provide important habitat for a great variety of living organisms. Fish and wildlife tend to be the focus of habitat management and restoration efforts. However, maintaining the ecological integrity of entire stream communities is vital for the long-term health and viability of fish and wildlife populations as well as biodiversity.

Streams and stream corridors evolve in concert with surrounding watersheds. Changes within a surrounding watershed will impact the physical, chemical, and biological processes occurring within a stream corridor. Stream systems normally function within a natural range of flow, sediment movement, temperature, and other variables in what is termed "dynamic equilibrium." When changes in these variables go beyond their natural ranges, dynamic equilibrium may be lost; often resulting in adjustments within the ecosystem that might conflict with societal needs and disrupt natural functions.

Over the years, human activities have contributed to changes in the dynamic equilibrium of stream systems. These activities center on manipulating stream corridor systems for a wide variety of purposes, including water supplies, irrigation, hydropower, waste disposal, flood control, timber management, recreation, aesthetics, and more recently, fish and wildlife habitat. Increases in human population and industrial, commercial, and residential development have placed heavy demands upon our stream corridors.

The cumulative effects of these activities result in significant changes, not only to stream corridors, but also to the ecosystems of which they are a part. These changes include degradation of water quality, decreased water storage and conveyance capacity, loss of habitat for fish and wildlife, and decreased recreational and aesthetic values.
(*Stream Corridor Restoration,* October 1998)

A number of human activities have resulted in the direct loss or degradation of riverine habitats. These include:
- the disruption of normal hydrology, such as the construction of dams and parking lots;
- degradation of water quality;
- erosion and sedimentation;
- riprap and other "hard" structure erosion control measures;
- stream channelization;
- extensive piping, or culverting, of streams through developed areas;
- introduction of invasive species;
- land use changes resulting in the loss or degradation of riparian areas; and
- withdrawal of water for drinking water supplies, irrigation or other consumptive uses.

Fortunately, stream channelization and piping are no longer common practices in Massachusetts. Hard structure erosion control measures are gradually giving way to "softer" approaches, such as bioengineering, that

have fewer adverse impacts on riverine habitats. Where streams have been altered by channelization, piping, or hard structure erosion control, there may be opportunities to reverse the damage through stream restoration.

3.21 Disruption of Riparian Areas

Land use has had a major impact on the Connecticut River watershed. Impervious surfaces, stormwater discharges, soil disturbance, and road and highway maintenance are just some examples of how land use has affected stream hydrology, water quality, erosion, and sedimentation. Of particular concern are riparian areas, as they serve as critical habitats and movement corridors for fish and wildlife. Disturbances in areas adjacent to rivers and streams can result in direct adverse impacts to riverine systems. Disruption of vegetated riparian areas also reduces the ability of these areas to serve as buffers between riverine systems and land use practices that would otherwise degrade rivers and streams. If properly implemented, the Rivers Protection Act should help protect existing riparian areas along rivers and perennial streams. The restoration of disturbed or degraded riparian buffers, and especially the removal of impervious surfaces within riparian areas, is another important strategy for protecting and enhancing riverine systems.

3.22 Impervious Surfaces

Parking lots, roads, bridges and other paved or impervious surfaces generate large quantities of stormwater runoff to streams. This is one of the most significant sources of non-point pollution to streams in the Connecticut River watershed. The table below illustrates typical examples of large impervious surfaces in two of the watershed's largest cities, Springfield and Holyoke.

3.23 Invasive Species

Invasive species, including plants (such as Water Chestnut, Japanese Knotweed, Phragmites, Fanwort, and Purple Loosestrife) and animals (Zebra Mussel and Hemlock Woolly Adelgid), are serious concerns throughout the Connecticut River watershed. In some cases riverine systems degraded by exotics can be partially restored by managing invasive species outbreaks. There are few reliable techniques for effectively managing outbreaks of invasive species. Avoiding the introduction of exotic (invasive or potentially invasive) species is a critical strategy for protecting riverine systems. Education can be effective in avoiding introductions or slowing the spread of invasive species.

3.24 Physical Barriers to River Connectivity

Dams are impenetrable barriers to upstream and downstream fish passage, and prevent access for anadromous fish species, such as Atlantic salmon and shad, to their historic spawning areas. According to the US Geologic Survey, there are 46 dams on the Connecticut River or tributary streams in Massachusetts (see table and map,next page). Only three of these dams have operating upstream fish passage facilities in place (Holyoke, Turners Falls and Mitteneague Dams), and

Table Seven. Largest Parking Lots and Buildings with Combined Impervious Areas Larger Than 5 Acres – Springfield and Holyoke

SPRINGFIELD		HOLYOKE	
Owner	**Size (est. acres)**	**Owner**	**Size (est. acres)**
Eastfield Mall	53	Holyoke Mall	200
Shopping Mall-Outer Belt Hwy.	30	K-Mart Plaza	100
Liberty Plaza	35	The Mill	32
U.S. Postal Service	28	Holyoke Plaza	30
Bradlees/Lechmere	28	Holyoke High School	30
Mass. Mutual	25	Dual Manufacturing/Mastex/Totsey	30
Monsanto	18	Monarch	30
Westvaco Envelope	18	Herman's Mall	25
WalMart	18	Mount Marie	25
K-Mart	15	Holyoke Community College	25
NE Utilities	12	Providence Hospital	25
Total Acres of Parking Lots/Buildings over 5 acres citywide	**483**	**Total Acres of Parking Lots/Buildings over 5 acres citywide**	**891**

Source: *Cleaning the Waters*, Pioneer Valley Planning Commission, 1994

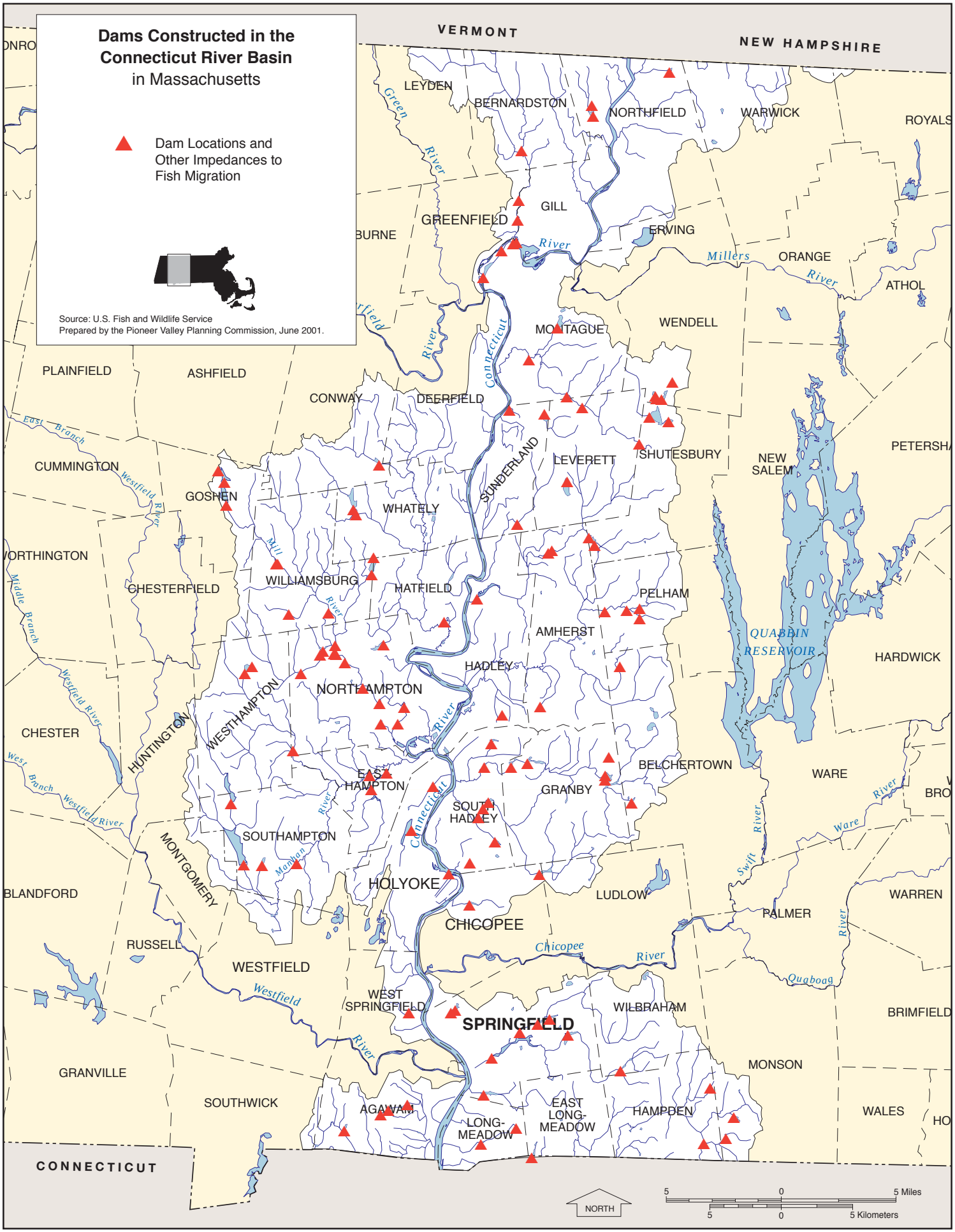

Dams Constructed in the Connecticut River Basin
in Massachusetts
Dam Locations and Other Impedances to Fish Migration
Source: U.S. Fish and Wildlife Service
Prepared by the Pioneer Valley Planning Commission, June 2001.
VERMONT
NEW HAMPSHIRE
CONNECTICUT
LEYDEN
BERNARDSTON
NORTHFIELD
WARWICK
ROYALS
GREENFIELD
GILL
ERVING
ORANGE
ATHOL
WENDELL
MONTAGUE
PLAINFIELD
ASHFIELD
CONWAY
DEERFIELD
SUNDERLAND
LEVERETT
SHUTESBURY
NEW SALEM
PETERSHA
CUMMINGTON
GOSHEN
WHATELY
WILLIAMSBURG
HATFIELD
PELHAM
AMHERST
QUABBIN RESERVOIR
HARDWICK
NORTHAMPTON
HADLEY
CHESTER
HUNTINGTON
WESTHAMPTON
EAST HAMPTON
SOUTH HADLEY
GRANBY
BELCHERTOWN
WARE
SOUTHAMPTON
MONTGOMERY
HOLYOKE
LUDLOW
PALMER
WARREN
BLANDFORD
CHICOPEE
RUSSELL
WESTFIELD
WEST SPRINGFIELD
SPRINGFIELD
WILBRAHAM
BRIMFIELD
GRANVILLE
SOUTHWICK
AGAWAM
LONG-MEADOW
EAST LONG-MEADOW
HAMPDEN
MONSON
WALES
Green River
Millers River
Connecticut River
Mill River
Middle Branch
East Branch
Westfield River
West Branch Westfield River
Chicopee River
Swift River
Ware River
Quaboag River
Manhan River
NORTH
5 0 5 Miles
5 0 5 Kilometers

Table Eight. Fish Passage Requirements within the Connecticut River Basin

River name[1]	Dam (Name or Owner)	Location (Town, State)	Use(s)	FERC Project Number[2]	Upstream Passage		Downstream Passage		Stocking Status[5]
					Need[3]	Functional Status[4]	Need[3]	Functional Status	
Connecticut River	Enfield Dam	Suffield, CT	Industrial (hyro proposed)	8404A	N	NN (breach, 1984)	N	No need/no hydro	Current
Connecticut River	Holyoke Dam: Hadley Falls Station	Holyoke, MA	Hydropower	2004A	N	O (fish lifts, 1955, 1976)	N	I (bypass, 1991)	Current
	Holyoke Canal	"	Hydropower Industrial	2004/others	NN	NP	N	O (louver/bypass, 1993)	Current
	Turners Falls Dam	Turners Fall	Hydropower	1889A	N	O (two ladders, 1980)	N	O (bypass, 1993)	Current
	Northfield Mountain[6]	Northfield, MA	Pumped Storage	2485A	NN	Not needed – not barrier	N	O (guide net, 1998?)	Current
Westfield River	DSI/Mitteneague Dam	W. Springfield	Hydropower	2608A	N	O (ladder & trap, 1996)	N	I (1995), O (1996)	Current
	Woronoco Dam	Woronoco, MA	Hydropower	2631A	D	NP	N	NP	Current
	Westfield Paper Dam	Woronoco, MA	None (hydro off line, 930	unlicensed*	D	NP	NN	No need/no hydro	Current
	Crescent Dam	Huntington, MA	Hydropower	2986A	N	O (trap & truck, 1996)	N	O (bypass, 19940	Current
Manhan River	Northampton St. Dam	Easthampton, MA	None	None	D	P (denil ladder)	D	NP	Current
Mill River (Northampton)	Route 10 Dam	Northampton, Ma	None	None	D	NP	D	NP	Future
	Paradise Pond Dam	"	None	None	D	NP	NN	No need/no hydro	Current
	Mill River Dam	"	None	None	D	NP	NN	"	Current
	Vistrom Dam	"	None	None	D	NP	NN	"	Current
	Rocky Pond Dam	"	None	None	D	NP	NN	"	Current
	Country Club Pond Dam	"	None	None	D	NP	NN	"	Current
	Button Shop #1 Dam	"	None	None	D	NP	NN	"	Current
	Button Shop #2 Dam	"	None	None	D	NP	NN	"	Current
	Chartpak Dam	"	None	None	D	NP	NN	"	Current
	Brass Mill Pond Dam	"	None	None	D	NP	NN	"	Current
	Near Graham Pond Dam	Williamsburg, MA	None	None	D	NP	NN	"	Current
Fort River	None	--	--	--	--	--	--	--	Current
Mill River (Hatfield)	Advocate Dam	Hatfield, MA	None	None	D	NP	D	NP	Current
	S. Deerfield Water Supply Dam	Whately, MA	Water supply	None	D	NP	NN	No need/ no hydro	Current
Roaring Brook	Roaring Brook Dam	Conway, MA	None	None	D	NP	NN	"	Current

Table Eight. Fish Passage Requirements within the Connecticut River Basin (cont'd)

River name[1]	Dam (Name or Owner)	Location (Town, State)	Use(s)	FERC Project Number[2]	Upstream Passage		Downstream Passage		Stocking Status[5]
					Need[3]	Functional Status[4]	Need[3]	Functional Status	
Sawmill River	Bookmill Dam	Montague, MA	None	None	N	Not needed/breached	NN	No need/no hydro	Current
Deerfield River	No. 2 Dam	Shelburne, MA	Hydropower	2323A	N	P (trap, w/trigger)	N	I (bypass, 1999)	Current
	Gardner Falls Dam	Shelburne, MA	Hydropower	2334A	D	NP	N	I (bypass, 1999)	Current
	No. 3 Dam	Shelburne, MA	Hydropower	2323B	D	NP	N	I (bypass, 1999)	Current
	No. 4 Dam	Buckland, MA	Hydropower	2323C	D	NP	N	I (bypass, 1999)	Current
Green River	Greenfield Tap & Dye	Greenfield, MA	None	None	D	NP	NN	NP	Planned
	Greenfield Elec. River Street	Greenfield, MA	None	None	D	NP	NN	No need/no hydro	Current
	Town Swimming Pool Pumping Station Dam	Greenfield, MA	None	None	D	NP	NN	"	Current
	Ten Mile Dam Green River Covered Bridge	Greenfield, MA	None	None	D	NP	NN	"	Current
		Leyden, MA	None	None	D	NP	NN	'	Current
		Guilford, VT	None	None	D	NP	NN	"	Current
South River	Conway Power Dam	Conway, MA	None	None	D	NP	NN	NP	Planned
North River	Kendall No. 1 Dam	Colrain, MA	None	None	D	NP	NN	No need/no hydro	Current
Mill River	JA Wells Upper Dam	Charlemont, MA	None	None	D	NP	NN	"	Current
Dunbar Brook	Dunbar Brook Dam	Rowe, MA	Hydro	None	D	NP	NN	"	Current
Fall River	Bernardston Dam	Bernardston, MA	None	None	D	NP	D	NP	Planned
Millers River	New Home Dam	Orange, MA	Hydropower	60906A.,B	D	NP	N	NP	Current
	Athol Dam	Athol, MA	Hyropower	Unlicensed	D	NP	N	NP	Current
	Cresticon Lower Dam	Athol, MA	Hydro[power	10163A	D	NP	N	NP	Current
	Cresticon Upper Dam	Athol, Ma	Hydropower	10163B	D	NP	N	NP	Current
	Tannery Pond Dam	Winchendon, MA	Hydropower	8895A	D	NP	D	NP	Future
	Hunts Pond Dam	Winchendon, MA	Hydropower	8012A	D	NP	D	NP	Not Planned

Source: Jan Rowan, U.S. Fish and Wildlife Service, June, 2001

Footnotes for Table Eight

1 Mainstem Connecticut River or Primary Tributary
- Secondary Tributary
- Tertiary Tributary

2 Asterisked (*) License numbers have been terminated.

3 Need: Status of the current need for passage facilities designated by the following:

N = Needed. Fish passage is needed based on management objectives and stocking program.
D = Deferred. Fish passage facilities will be required in the future when conditions (e.g. the presence of anadromous fish above or below the dam) merit. Construction of facilities is not mandated at this time.
NN = Not needed. Fish passage facilities are inherent due to dam structure or operation, or stocking is not planned for river stretches above the dam.
U = Unscheduled. Fish passage facilities are not required at this time but the federal and state agencies reserve the right to reconsider this finding in the future based on changing conditions.

4 Functional Status:
O = Operational final facility.
I = Interim facilities in place. Final facilities under study, in planning or yet to be pursued. Interim facilities may or may not be fully effective.
P = Planned. Facilities being planned or under construction.
NP = Not planned. Facilities may or may not be required in the future.

5 Status of fry stocking upstream of listed barrier.

6 Northfield Mountain Pumped Storage Facility is not a dam but significantly impacts smolt survival during the water withdrawals from the river.

7 Experimental fry stocking initiated in 1997.

one dam has a fish passage facility planned (Northampton Street Dam on Manhan River). There are 42 dams with no fish passage facilities in place, and many of these do not have plans for future fish passage installations.

Other physical barriers to river connectivity are present, but not inventoried in the Connecticut River watershed. These barriers, which can affect not only fish, but also animal species, include:
- road and railroad crossings and culverts;
- channelized stream corridors and piped streams;
- highway, livestock and residential fencing, particularly along river edges.

A comprehensive inventory and assessment of these barriers is needed in the Connecticut River basin.

3.25 Atlantic Salmon Restoration

When Europeans first settled the Connecticut River watershed, Atlantic salmon were found throughout the watershed. Other migratory fish, including American shad and river herring were also abundant. But with the construction of the impassable Turners Falls dam in 1798, salmon access was blocked and this species disappeared from the river a few years later. The numbers of other migratory fish also declined.

Efforts to restore Atlantic salmon were attempted as early as the 1860s. The current Atlantic Salmon Restoration Program commenced in 1967 and is an interagency effort that addresses other migratory fish as well. Agency efforts are guided by the Connecticut River Atlantic Salmon Commission, composed of the U.S. Fish and Wildlife Service, National Marine Fisheries Service and four state fish and wildlife agencies: Connecticut Department of Environmental Protection, Massachusetts Division of Fisheries and Wildlife, New Hampshire Fish and Game and Vermont Fish and Wildlife. The current Program has been aided by the Clean Water Act which improved water quality and the environment, the Anadromous Fish Conservation Act which provides funding, and improved technologies for fish passage and genetics management.

Since the program was initiated three decades ago, an annual return of sea-run Atlantic salmon, numbering in the hundreds, has been established. Upstream passage is in place at the first five mainstem dams, and downstream passage is in place at the lowermost eight mainstem dams. A rapid increase in returning salmon from 1978-1981 raised hopes that progress would be sustained at that pace, however returning salmon numbers have not changed much over the past ten years. The steady numbers are considered a sign of success, but "it will take a long time to restore salmon to the basin", according to the *Strategic Plan for the Restoration of Atlantic Salmon to the Connecticut River,*

(Connecticut River Atlantic Salmon Commission, 2001). The annual budget for all migratory fish is approximately $2 million.

Table Nine. Connecticut River Migratory Fish Counts 1998-99

Fish Type	Year 1998 Total Fish Pasage Counts	Year 1999 Total Fish Passage Counts	Year 2000 Total Fish Passage Counts
Atlantic Salmon	300	154	77
American Shad	318,372	196,549	228,859
Blueback Herring	11,646	2,735	10,558
Gizzard Shad	1,094	35,134	38,124
Sea Lamprey	101,758	22,142	24,090
Shortnose Sturgeon	25	1	0
Striped Bass	503	861	489

Totals observed at four dams in the Connecticut River watershed
Source: U.S. Fish and Wildlife Service, 2001

The major obstacles facing fisheries managers include tremendous success in restoring striped bass to the point that the striper population is impacting other fish populations in the river including blueback herring, decreased ocean survival of Atlantic salmon in North America and Europe, freshwater quality and habitat fragmentation by dams and other obstacles to fish passage.

3.26 Water Withdrawals

Communities in the Connecticut River Basin will be faced with increasing demands for limited water resources as we move into the 21st Century, due to regional growth pressures, loss of supplies due to pollution, and other demands. A major objective of public water supply management is to help communities avoid current or potential water shortages. Water shortages typically occur during drought periods, when demand tends to be higher, primarily due to an increase in outdoor watering, and supplies tend to be scarcer, primarily due to lower reservoir and water table levels and reduced stream flows. Water suppliers have typically turned to increasing water withdrawal volumes or new source development, usually in the form of more water supply wells, in response to an actual or perceived shortfall between current supply and demand. Why is this a problem? Increasing withdrawal volumes or new source development is likely to be more environmentally harmful, and often more costly, than alternative methods of closing the gap between water demand and supply.

Withdrawals, diversions and other artificially induced reductions in water levels in rivers, streams, vernal pools, wetlands and other hydric ecosystems have the potential for causing serious ecological damage, especially during drought periods. Water is an essential component of aquatic and other water-dependent ecosystems such as wetlands. The presence of water in sufficient amounts and periods of time is crucial to the continued survival of many plants and animals in these areas. Removal of water from these areas can cause significant environmental damage, depending upon the time, location and amount of the withdrawal and the sensitivity of the affected areas.

Droughts and other low water events are especially stressful times for fish and other water dependent organisms. Most of these species have evolved to withstand a certain level of stress resulting from naturally occurring drought periods. Water withdrawals and diversions for water supply or other purposes, however, can significantly increase the duration, frequency and severity of drought conditions. This artificially induced drop in water levels may lead to a marked decline in the quality and quantity of habitat for water dependent species in rivers, streams, and wetlands. Such an impact is likely to result in the demise of sensitive, and often the most ecologically significant, species and a drop in overall species diversity, a key indicator of ecological health.

This problem is further aggravated by the fact that withdrawal points are often located within the shrinking inventory of relatively unspoiled and uncontaminated areas that possess high ecological values and sensitivities. This is the case in much of the Connecticut River watershed, where a substantial proportion of the water supply withdrawal points are located in or adjacent to the smaller tributary or headwater streams, which tend to be less contaminated than downstream areas. Many of these stream reaches currently, or at least prior to water supply development, consist of pristine, high quality, “coldwater” stream habitats, ideal for brook trout, Atlantic Salmon, and many other organisms with similar habitat needs. Unfortunately, however, their modest size makes these tributary streams espe-

cially vulnerable to water supply diversions and withdrawals, as even a modest-sized withdrawal can result in a substantial adverse impact on streamflow.

A current or potential gap between water demand and existing supplies can be closed by either: obtaining more water from existing or new sources; or through greater efficiencies in water delivery and use. In general, efficiency improvements coupled with demand oriented drought planning are a cheaper, more reliable and more environmentally beneficial means of alleviating water shortages than is new source development. Droughts and other low water periods are the worst time for streams and other water-dependent habitats to suffer additional withdrawals for public water supply and other purposes. Therefore, water suppliers and the state agencies that advise, fund and regulate them should adopt a policy which gives the promotion of improved efficiency in water delivery and use a clear preference over expanding withdrawals and or diversions. Water suppliers should be redirected away from their current focus on identifying new sources of water for satisfying projected increases in demand and toward solving current or potential gaps between supply and legitimate need through improvements in efficiency and drought contingency planning based on demand management.

3.27 Data Gaps

There is a lack of state agency staff to assess water quality and other environmental conditions of tributary streams. Local volunteers should be recruited and trained to do this assessment work. These volunteers should be encouraged to "adopt" and take stewardship responsibilities for the stream on an ongoing basis.

In addition, further analysis is required to determine the impacts of reduced water quantity in streams including:

- research into the impact of water withdrawals for public and private water supplies, agriculture and other uses on aquatic and other water dependent organisms and habitats;
- identifying locations of surface and groundwater withdrawal points (for public water supply, agriculture and other uses); some of these may fall below the Water Management Act's regulatory threshold of 100,000 gallons/day, yet have a significant adverse impact on the stream reaches, wetlands, etc., where they are located;
- determining the resource values of water dependent ecosystems and assessing the adverse ecological impacts of water withdrawals, if any.

Currently, DEP, USACE and DFWELE are working collaboratively on the "Stream Flow and Habitat Project", which should provide better guidance on on appropriate methods for addressing stream flow and habitat issues.

3.3 STRATEGIES FOR STREAM AND WILDLIFE HABITAT PRESERVATION

Strategy #8 (Stream Preservation): Encourage and Support the Establishment of Stream Teams on Tributaries and the Mainstem of the River.

Stream teams should be supported in as many of the river's tributary watersheds as possible. The members of these stream teams will become informed and active participants in the management of their individual subwatersheds as well as the larger watershed. This very local, grass roots, approach to watershed management will increase the identification of problems and implementation of solutions to improve water quality, wildlife habitat, and other environmental values. It will create a greater constituency of environmental advocates that can prevent future problems caused by unwise land use practices. Finally, it will serve to increase public awareness of water quality and better watershed management practices.

Staff from the Riverways Program provide training in the Adopt-A-Stream methodology through local workshops. Established teams then conduct shoreline surveys using the accepted Riverways methodology. A plan is developed to guide future actions in the watershed. Professional staff provide organizational and technical guidance to the stream teams through such tasks as meeting scheduling, plan writing, publicity, and outreach to municipal officials. This approach has been successful in the Mill River (Hatfield) watershed (see Volume 2 of this report for details).

Recommended Actions:

31) **Organize stream teams, where necessary, through outreach efforts, meetings, and training sessions.**
   - Identify existing organizations and issues that need technical support and assistance;
   - Conduct stream assessments using team members to complete in-the-field surveys, compile survey information, and evaluate survey results; and
   - Develop an action plan to guide the future work of the stream team through meeting with the teams and writing drafts for review and approval of the team.
   - Provide technical assistance to implement recommended actions.

32) **Support existing subwatershed organizations by providing technical assistance.**
   Existing subwatershed organizations such as The Mill River Partnership in Springfield, Friends of the Manhan, and the Sawmill River Alliance rely on volunteer efforts that could be supported through grant writing, development of educational material, or other technical assistance.

Strategy #9 (Stream Preservation): Ensure adequate fish passage in the mainstem and subwatershed branches of the river.

Recommended Actions:

33) **Advocate, through the Federal Energy Regulatory Commission hydroelectric relicensing process, for all facilities to operate on a "run of the river" basis so that the impact on naturally occurring stream flow levels are minimized.**

plan is developed to guide future actions in the watershed. Professional staff provide organizational and technical guidance to the stream teams through such tasks as meeting scheduling, plan writing, publicity, and outreach to municipal officials. This approach has been successful in the Mill River (Hatfield) watershed (see Volume 2 of this report f

34) **Continue to support the return of species such as the Atlantic Salmon to the Massachusetts reach of the Connecticut River.**
- Oppose new dam construction and reconstruction of breached dams that will impact salmon habitat or migration;
- Support plans to breach or remove old dams that obstruct or impede upstream or downstream fish passage;
- Utilize state and federal regulatory authorities to ensure that fish passage is provided as needed at all licensed and permitted dams;
- Support modification of hydropower operations to help ensure river flows necessary to support anadromous fish migration;
- Continue to share information and work cooperatively with dam owners, other river developers, and non-governmental partners to resolve fish passage concerns;
- Minimize passage obstructions, migratory delays and mortality (in turbines, etc.) of Atlantic salmon smolts and kelts downstream of areas stocked with fry, parr, smolts or adults;

35) **Support and work to ensure that both upstream and downstream fish passage is installed at non-licensed dams and or river obstructions.**
- seek private funding and federal grants;
- organize stream teams to monitor existing fishways for efficiency, timing and standards of operation;
- migratory delays and obstructions to instream movements should be minimized or eliminated for salmon, other migratory species including lampreys and eels, as well as native species including trout and freshwater mussels.

Strategy #10 (Stream Preservation): Prevent the introduction or spread of non-native, invasive species, especially nuisance aquatic species.

The Conte National Wildlife Refuge has been very active in the management of invasive species. The Basin Team should continue to provide support (political and financial) for the Silvio O. Conte National Fish and Wildlife Refuge. The Nature Conservancy has developed brochures that have been distributed to the public.

Recommended Actions:

36) **Support agency and non-governmental organizations, such as the New England Wildflower Society, that are working to educate the public about the spread of exotics.**

37) **When possible, prevent the spread of existing invasive species, especially in areas where they threaten populations of rare or endangered native species or pristine natural communities.**

Strategy #11 (Stream Preservation): Reduce the impact of water withdrawals downstream of public reservoirs and withdrawal points.

Existing water withdrawals and diversions are already aggravating levels of environmental degradation caused by the lack of water in water dependent ecosystems, especially during drought events. There are reports from various areas in the Connecticut River watershed from citizens that have witnessed first hand a number of rivers and streams affected by upstream water supply withdrawals that have ceased flowing and/or dried up completely. For example, the Mill River Watershed Project (Scott Jackson, project contact person) have reported such occurrences on Roaring Brook below the City of Northampton's reservoir in Whately, and on West Brook below the Town of South Deerfield's reservoir. In these cases, water suppliers are acting within their permit requirements, but flow problems could be addressed when permits are re-issued.

Recommended Actions:

38) **Make modifications to the timing and rates of public water supply pumping to reduce adverse impacts on stream flows and water levels.**
The state's current system for permitting water withdrawals is primarily focused on ensuring that withdrawals from one municipality will not threaten water supplies for another. In some cases TMDL calculations may be used to ensure ad equate stream flow to dilute water-borne pollutants. Although the Water Management Act regulations indicate that important natural resources must be protected, there are no standards or methods specified for determining when environmental impacts would be unacceptably large. It is

important that water withdrawal permitting adequately protect the ecological integrity of streams or habitats for fish and wildlife that are dependent on naturally occurring stream flow patterns and volumes.

39) **Establish ecologically-based streamflow requirements, using the Mill River (Hatfield) as a case study.**
The Mill River (Hatfield) Watershed contains important populations of a host of state and federally listed species and an exemplary flood plain forest community (as identified by the Natural Heritage and Endangered Species program). It also has been the subject of intensive hydrological and biological studies over the past three years. Each of the Mill River's three main tributaries contain drinking water reservoirs and two of the streams (West Brook and Roaring Brook) already experience no-flow conditions during dry periods. Water that is withdrawn from these reservoirs is discharged outside of the Mill River watershed. Concern has been expressed about the impacts of a recent increase in water withdrawals from the West Brook. A permit request for additional water withdrawals from the Roaring Brook is pending before DEP.

The Mill River basin could be a case study for a more ecologically-based approach to setting stream flow requirements. Research is needed to determine whether it is possible to establish ecological thresholds for ecosystem change within water sheds. This approach would involve modeling various levels of water withdrawal to determine the relationships between stream flow and stream ecology. Information about the most responsive ecological variables and habitat suitability modeling could be used to determine an ecological threshold for stream flows.

Strategy #12 (Stream Preservation): Restore vegetated riparian buffers.

Riverine habitats can become fragmented by manmade conditions. Channelization, piping, the lining of stream channels with impervious surfaces, and hard structure erosion controls often create habitat discontinuities that fragment and isolate plant and animal populations. Small and isolated populations are more vulnerable to genetic changes and extinction due to chance events.

Recommended Actions:

40) **Map priority areas for protection or restoration of vegetated riparian buffers.**

41) **Provide education about the importance of vegetated riparian buffers and headwater streams.**
- Develop and present workshops on riparian systems for a variety of audiences including stream teams, landowners, developers, and public officials.

- Adapt the recommendations from the Connecticut River Joint Commissions or the *Chesapeake Bay Riparian Handbook* for use in the Massachusetts reach of the Connecticut River Watershed.

42) **Preserve, protect, and improve vegetated riparian buffers.**
- Promote agricultural best management practices listed in the DEP *"Megamanual"*.

- Investigate funding options, such as purchase of conservation restrictions, for compensating farmers for retiring sensitive agricultural land (e.g. riparian areas).

- Seek additional funding (e.g. Conte Refuge Challenge Grants) to purchase and retire riparian agricultural land.

43) **Address the impacts of impervious surfaces in riparian areas**
- Remove impervious surfaces within 50 feet of streams, wherever possible, and replace with vegetation suited to riparian areas.

- Investigate functional replacements for impervious surfaces and seek opportunities to replace impervious surfaces with more pervious alternatives within 100 feet of streams.

- Where impervious surfaces exist and cannot be removed, reduce stormwater runoff through BMP installation.

- Federal funding may be available for some of all of the above through Section 319 of the Clean Water Act.

Strategy #13 (Stream Preservation): Restore River Connectivity

As long and linear features on the landscape, riverine systems are vulnerable to habitat fragmentation due to physical barriers and alterations that create discontinuities in habitat. Physical barriers include dams, culverts, bridges, fences and other structures that may block the movement of plants and animals upstream or downstream within riverine systems. Dams have received a lot of attention due to their impact on fish passage. Relatively little attention has been paid to

culverts. In smaller rivers and streams, culverts can present a variety of problems for animal passage including:

- high drop-offs at either end of the culvert;
- lack of pools at downstream end of the culvert;
- water too shallow for fish passage;
- water velocity too high for upstream passage;
- lack of appropriate bottom substrates (cover for salamanders and invertebrates);
- lack of bank habitat for terrestrial movement along streams.

Recommended Actions:

44) **Develop strategies for the removal of barriers to river connectivity.**
- Develop a review process to identify and assess the impacts of, barriers to riverine connectivity (dams, channelized stream segments, piped stream segments).
- Prioritize barriers for removal or mitigation (identify locations of road kill "hot spots"), see what can be done to mitigate (salamander underpass, "deer crossing" signage, reduced speed limits, migration warning sign, police or citizen crossing guards to assist amphibians during migration nights, etc.)
- Develop strategies for the removal of barriers beginning with highest priority sites.
- Work with the Office of Dam Safety and the River Restore Program to identify opportunities for dam removal and conduct site specific assessments of positive and negative impacts of dam removal.
- Review USFWS GIS database on barriers (USFWS Ct. River Coordinator's Office) to identify projects for contact with dam owners, permitting, and implementation.

45) **Upgrade driveway, road, highway, and railroad stream crossings to promote greater fish and wildlife passage.**
- Develop standards for culverts and bridges to allow for fish/wildlife passage.
- Develop a process for conducting assessments of existing culverts/bridges to identify those that present the most significant barriers to connectivity (Watershed teams or training for stream teams).
- Prioritize a list of problem areas.
- Seek commitments from MassHighway or local DPWs to set annual goals for upgrading stream-crossing structures, beginning with the highest priority sites.
- Develop a working relationship between the Connecticut River Watershed Team and MA Highways District Office(s) to provide better planning for highway projects, including to adoption of culvert standards for fish/wildlife passage.
- Watershed Team Leader should regularly review the Environmental Monitor for large and/or complicated projects and offer the services of the Watershed Team in providing technical assistance to municipal boards involved in permitting those projects.
- Develop and conduct educational programs on the value of, and issue related to, stream connectivity.

46) **Work with the MA Highway Department review and address barrier issues and road grading as part of road upgrade or reconstruction projects, possibly as part of MEPA review.**
Sediment is often shunted into fish nursery habitat during road construction projects. There is a need to work with MHD and town DPWs to improve understanding of impacts and practices.

4.0

LAND USE, GROWTH, AND ECONOMIC DEVELOPMENT

4.1 PUBLIC RESPONSE AND PARTICIPATION

PRIORITY LAND USE GOALS

Based on a Watershed Survey of civic leaders in all Massachusetts communities in the Connecticut River main stem watershed, the most important goals for achieving sustainable land use, growth and economic development for the Connecticut River are (ranked in order of priority):

1) encourage good development practices that to do not adversely affect water quality, wildlife habitat and stream functions;

2) assist communities to protect open space (e.g. open space planning, zoning guidelines);

3) complete Master Plans and revise zoning regulations;

4) promote "Smart Growth" (more compact growth centered around existing community centers, with open space protection) as an alternative to sprawl;

5) provide for increased intermunicipal cooperation;

6) promote environmentally sustainable economic development, such as agriculture;

7) promote and facilitate Brownfields redevelopment;

8) promote tourism, based on river-oriented recreation, farm stays, historical sites;

9) develop environmentally sustainable industry, such as an eco-industrial park.

PRIORITY LAND USE PROBLEMS

The most significant **land use, growth and economic development problems** identified by civic leaders are as follows (ranked in order of priority):

1) loss of farmland and forestland to development;

2) environmental impacts from poor development practices, such as stormwater runoff

3) low density urban sprawl and its impacts on community character, open space and water quality;

4) lack of protected open space and local open space plans;

5) lack of cooperation between communities;

6) need for restoration and redevelopment of Brownfields sites (abandoned or underutilized industrial or commercial sites, which may have environmental contamination);

7) lack of local Master Plans;

8) outdated zoning regulations;

9) lack of environmentally sustainable economic development.

Based on the "Connecticut River Watershed Public Brainstorming Session" held 11-14-98 in Hadley, MA, the following issues were identified as top priority land use, growth and economic development concerns for residents of the watershed:

1) Protection of open space, rural character and working landscapes, such as farms and forests. Suggested actions included;
   - inhibit uncontrolled growth:
   - revise and strengthen local land use regulations to include open space planning considerations;
   - educate the public, including farmers and homeowners, on pollution sources.
2) Promote economic sustainability for rural econo - mies. Suggested actions included:
   - support farmers, forestry, home businesses, community development corporations, and small businesses serving local economies, tourism and recreational uses associated with rural landscapes (i.e. eco-tourism, historic village centers).
3) Encourage redevelopment, restoration and re-use of Brownfields. Suggested actions included:
   - planned redevelopment through public/private partnerships.
4) Promote development of heritage tourism links with the river, including historic sites near the river, bikeways, recreation areas, parks. Suggested actions included:
   - promoting river access through development of greenways and green corridors, bike trails, removal of physical constraints, redevelopment and safety improvements;
   - developing a signage program and walking tours linking downtowns to the riverfront, showing historic and cultural ties;
   - create an American Precision Manufacturing Heritage Corridor, linking important assets, such as South Hadley Canal, Springfield Armory, Great Falls Discovery Center, Connecticut River Greenway State Park, Northfield Mountain Recreation Area, riverboat tours and archaeologic sites;
   - develop a valley-wide tourism program which includes web site, maps, signage, travel and accomodation information, historic markers, walking tours, well-lighted and marked river access points, adequate sanitary facilities and rules for use;
   - encourage new tourist/recreational ventures with private capital, following model of Hartford's Riverfront Recapture.

4.2 ASSESSMENT OF THE CURRENT SITUATION

4.21 Land Use

Low-density urban sprawl has become the Pioneer Valley's dominant form of growth. Within the lifetime of many current residents, 34,000 acres of land in the Pioneer Valley region have been developed for urban uses, a 71% increase (from 1952 to 1985). The development of land for urban uses is accelerating in the Pioneer Valley Region (Hampshire and Hampden County). In the fourteen years between 1971-1985, a total of 15,542 acres of open land was converted to urban use in the region, a rate of 1,110 acres per year. PVPC estimates that in the nine years between 1986-95, a total of 13,430 acres of land was developed, a rate of 1,492 acres per year.

Table Ten. Pioneer Valley Communities With the Greatest Increases in Urbanized Land (1971-1995)

Municipality	Total Urbanized Acres
1. Belchertown	2260
2. Westfield	2084
3. Agawam	1541
4. Monson	1387
5. Southwick	1303
6. Westhampton	1165
7. Palmer	1163
8. West Springfield	1014
9. Chicopee	956
10. Springfield	933
10. Northampton	933

Sources: 1971-85 Land Use Resource Mapping Project, Umass, Amherst and *Valley Vision*, Pioneer Valley Planning Commission, September, 1997.

The highest rates of land conversion are occurring primarily in suburban and, increasingly, in exurban communities. While the region's total population grew at only a 3.6% rate from 1980-90, exurban communities such as Belchertown, Plainfield, Worthington, Wales, Holland, Brimfield, Pelham, Gill, Leverett, Leyden, Shutesbury, Warwick, Wendell, and Tolland experienced the watershed's highest rates of growth at over 20% each. Belchertown, the PVPC region's fastest growing community, has seen its population grow 40% from 1970-80 and another 27% from 1980-90. According to FRCOG, between 1970-1990, the fastest growing communities in their region were Shutesbury (219%), Wendell (122%) and Leverett (77%).

4.22 Buildout Analyses

During 2000-2001 under its Community Preservation Initiative, the Executive Office of Environmental Affairs, working with the state's 13 regional planning agencies, completed a series of community-based Buildout Map and Analyses for all 351 of the communities in the Commonwealth. A "buildout analysis" consists of a series of 4 or 5 geographical information system (GIS) based maps that illustrate a community's current zoning, the land available for development and how it is zoned, and maximum development possible in a

particular community if every piece of developable land were developed based upon existing local zoning. Accompanying the maps are projections of the numbers of residents, households, public school students and water use at buildout. The buildout analysis provides a baseline for communities by demonstrating development as it could occur if no changes are made in current zoning. It is a planning tool designed to stimulate discussion and help communities identify if they are growing in the way they want and what, if any, changes they want to make. EOEA's Watershed Team Leaders and RPAs are presenting each city or town's buildout analysis to City Councils and Boards of Selectmen in all 351 communities.

Buildout Analysis: The buildout maps and analysis consist of a series of 4-5 GIS maps. Buildout Map 1 depicts the current developed land and land which is permanently protected in color, with developable land in white. Buildout Map 2 provides the inverse of Map 1 by shading areas which are developable and color-coding them to indicate specific zoning (i.e. residential, commercial, mixed-use, etc.). Buildout Map 3 is a summary map, showing land available for additional growth. Buildout Map 3, also presents summary statistics for the analysis based upon the Buildout Map 2 calculations. Buildout Map 4 consists of an orthophotograph of the community.

Some of the key results of Buildout Analyses for communities in the Connecticut River Watershed are shown in Table Eleven below. The analyses illustrates that, at buildout under current zoning regulations, many watershed communities would experience dramatic increases in developed land and population. Some examples include:

- Westhampton: an 1800% increase in population from 1327 current residents to 25,642 residents at buildout;
- Belchertown: a 297% increase in population from 13,158 to 52,333 residents;
- Southampton: a 474% increase in population from 4478 to 25,725 residents.

Not surprisingly, buildout impacts are greatest in suburban communities at the edge the urban core, which still have significant farmland or undeveloped land available. The impacts are somewhat less in already-developed urban areas and in rural hilltowns where steep slopes limit developable land.

Table Eleven. Buildout Analyses for Connecticut River Watershed Communities

Community	Total Developable Acres	Potential New Residential Units	Potential New Residents
Hampden County			
Agawam	4,954	9,007	19,022
Chicopee	2,457	3,738	9,345
East Longmeadow	3,019	1,739	4,698
Hampden	7,064	3,788	10,177
Holyoke	5,375	6,661	18,498
Longmeadow	997	1,335	3,712
Ludlow	7,428	5,784	14,583
Montgomery	6,012	1,766	5,352
Springfield	23,056	-	-
West Springfield	2,332	2,371	3,699
Wilbraham	6,962	4,453	12,463
Total	***69,656***	***40,642***	***101,549***
Hampshire County			
Amherst	5,708	2,146	5,623
Belchertown	21,679	17,679	53,364
Chesterfield	11,719	4,201	12,215
Easthampton	3,254	4,704	11,853
Goshen	8,257	3,176	8,797
Granby	11,993	8,590	22,934
Hadley	8,805	2,880	8,351
Hatfield	7,119	6,260	13,145
Huntington	10,069	3,014	8,500
Northampton	11,555	8,370	19,084
Hampden County			
Pelham	5,982	2,250	5,183
South Hadley	4,714	4,537	12,839
South Hampton	11,756	7,086	20,548
Westhampton	13,450	8,105	24,315
Williamsburg	7,360	5,571	15,041
Total	***143,420***	***88,569***	***241,792***
Franklin County			
Bernardston	10,239	6,833	18,041
Conway	14,256	4,781	13,195
Deerfield	12,398	7,760	18,624
Erving	3,463	4,490	11,718
Gill	5,970	2,769	7,118
Greenfield	5,796	7,771	18,883
Leverett	10,453	6,074	16,764
Montague	9,778	6,413	15,256
Northfield	13,635	7,508	18,847
Shutesbury	8,693	3,567	9,953
Sunderland	4,705	4,129	10,464
Warwick	9,819	4,221	12,663
Wendell	7,513	2,125	5,524
Whately	8,336	6,270	16,967
Total	***125,054***	***74,711***	***194,017***
GRAND TOTAL*	***338,130***	***203,922***	***537,358***

*Does not include totals for Potential Residents and Residential Units for City of Springfield

Ecological Impacts of Development

When development occurs, it can lead to dramatic changes to the hydrology, or the way water is transported and stored. Impervious man-made surfaces (asphalt, concrete, and rooftops) and compacted earth associated with development create a barrier to the percolation of rainfall into the soil, increasing surface runoff and decreasing groundwater infiltration. This disruption of the natural water cycle leads to a number of changes, including:

- increased volume and velocity of runoff;
- increased frequency and severity of flooding;
- peak (storm) flows many times greater than in natural basins;
- loss of natural runoff storage capacity in vegetation, wetlands and soil;
- reduced groundwater recharge; and
- decreased base flow, the groundwater contribution to stream flow, resulting in streams becoming intermittent or dry, and affecting water temperature.

Other ecological impacts of development include:

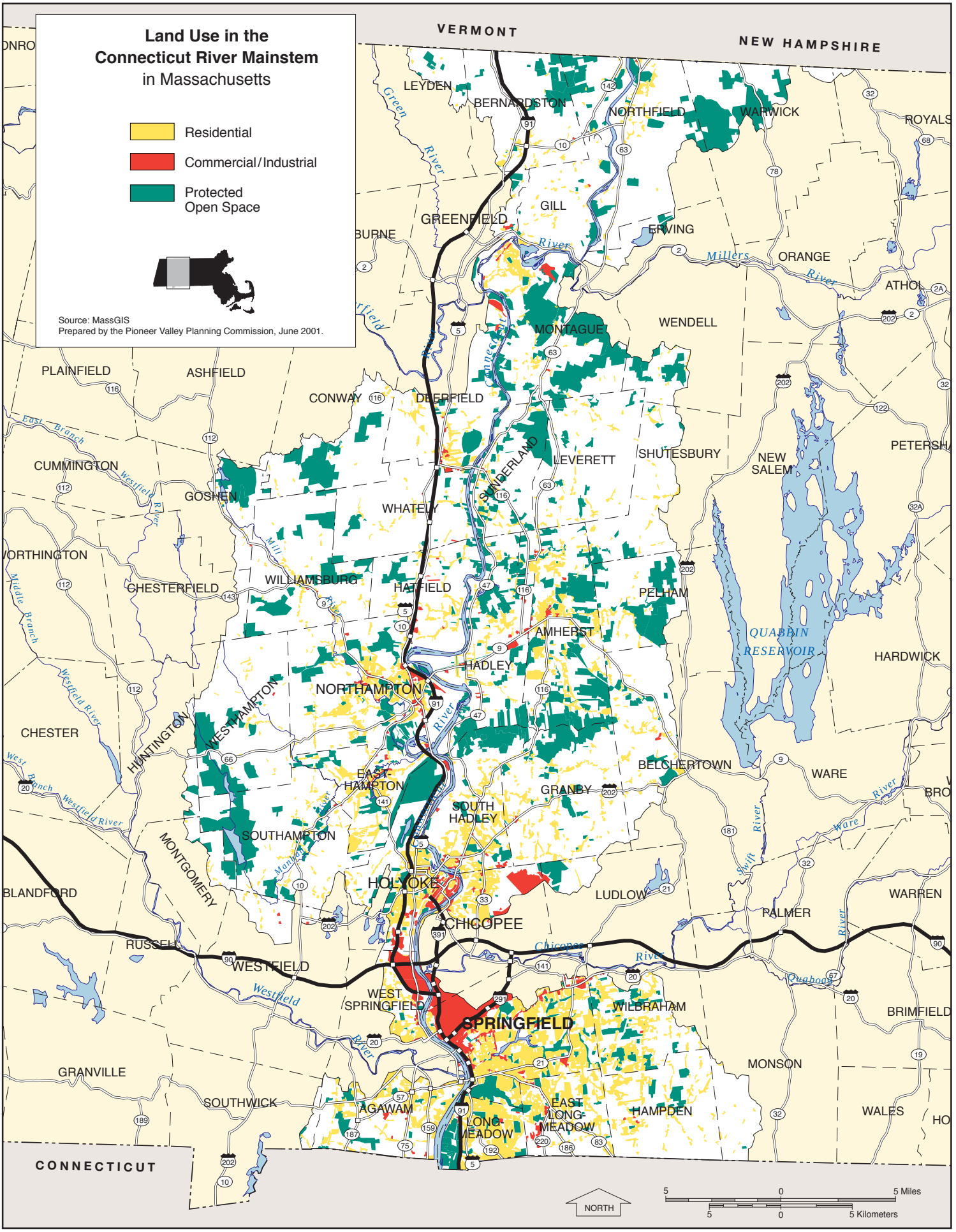
Habitat: Outright destruction, physical alteration, pollution and wide fluctuation in water conditions (levels, clarity, temperature) all combine to degrade habitat and reduce the diversity and abundance of aquatic and riparian organisms. In addition, waterway obstructions like bridge abutments, pipes and dams create barriers to migration.

Pollutant removal: Greater pollutant loads in the urban environment serve to decrease the effectiveness of natural processing. Damage to bank, stream and wetland vegetation further reduces their ability to naturally process pollutants. Finally, the greater volume and irregular, "flashy" pulses of water caused by stormwater runoff impair natural processing by decreasing the time that water is in the system. Polluted stormwater runoff is now widely recognized by environmental scientists and regulators as the single largest threat to water quality in the United States. The major pollutants of concern are pathogens (disease-causing microorganisms), nutrients, toxic contaminants and debris. Sediment is also a major nonpoint source pollutant, both for its effects on aquatic ecology and because of the fact that many of the other pollutants tend to adhere to eroded soil particles.

Many studies are finding a direct relationship between the intensity of development in an area (as indicated by the amount of impervious surfaces) and the degree of degradation of its streams. These studies suggest that aquatic biologic systems begin to degrade at impervious levels of 12% to 15%, or at even lower levels for particularly sensitive streams. As the percentage of imperviousness climbs above these levels, degradation tends to increase accordingly.

To begin to truly address the impacts of development, town officials need to look at their waterways as an interconnected system and recognize the fundamental changes that development brings to the water cycle, stream form and function, aquatic ecology, and water quality. Incorporating this understanding into local land use decisions can help to guide appropriate development. There are a number of options that can be employed to reduce the impacts of development on water quantity and quality. Preventing such impacts in the first place is the most effective (and cost effective) approach and should always be emphasized. To this end, local officials should consider a three-tiered strategy of:

- natural resource based planning;
- appropriate site design; and
- stormwater treatment.


Land Use in the
Connecticut River Mainstem
in Massachusetts
Residential
Commercial/Industrial
Protected
Open Space
Source: MassGIS
Prepared by the Pioneer Valley Planning Commission, June 2001.
VERMONT
NEW HAMPSHIRE
CONNECTICUT
LEYDEN
BERNARDSTON
NORTHFIELD
WARWICK
ROYALSTON
GREENFIELD
GILL
ERVING
ORANGE
ATHOL
WENDELL
MONTAGUE
PLAINFIELD
ASHFIELD
CONWAY
DEERFIELD
SUNDERLAND
LEVERETT
SHUTESBURY
NEW SALEM
PETERSHAM
CUMMINGTON
GOSHEN
WHATELY
WILLIAMSBURG
HATFIELD
PELHAM
AMHERST
QUABBIN RESERVOIR
HARDWICK
NORTHAMPTON
HADLEY
CHESTERFIELD
WORTHINGTON
CHESTER
HUNTINGTON
WESTHAMPTON
EAST HAMPTON
SOUTH HADLEY
GRANBY
BELCHERTOWN
WARE
SOUTHAMPTON
MONTGOMERY
HOLYOKE
LUDLOW
PALMER
WARREN
BLANDFORD
CHICOPEE
RUSSELL
WESTFIELD
WEST SPRINGFIELD
SPRINGFIELD
WILBRAHAM
BRIMFIELD
MONSON
GRANVILLE
SOUTHWICK
AGAWAM
EAST LONGMEADOW
LONGMEADOW
HAMPDEN
WALES
Connecticut River
Westfield River
Mill River
Manhan River
Chicopee River
Ware River
Swift River
Quaboag River
Millers River
Green River
East Branch
Middle Branch
West Branch
NORTH
5 0 5 Miles
5 0 5 Kilometers

4.23 Economic Development

While economic development is important, it must be compatible with the character of the region and supportive of the natural resource base. The manufacturing sector, with relatively high paying jobs, should be located within industrial parks, mill complexes or growth areas identified by communities which have adequate water, sewer and transportation infastructure to sustain the community aas well as the industry. Businesses which minimize the use or production of hazardous materials should be targeted for recruitment to the area. Commercial businesses should be directed to existing town centers or growth areas identified by town Master Plans and should be mixed with residential development to support pedestrian, traffic and transit services. Tourism and recreation present many opportunities for expansion in the region. Agriculture is also an important existing economic sector which should be supported and maintained.

Tourism and Recreation

Tourism is the second largest industry in Massachusetts, and there is tremendous opportunity in the Connecticut River watershed for tourism expansion. Economic development strategies should capitalize on the region's ammenities, such as the natural resources, to expand tourism within the watershed. Tourism can be a relatively lowimpact activity that can encourage the preservation and restoration of the historic, cultural, and environmental resources within the region.

Improved water quality in the river continues to have a major impact on tourism and recreation. There are several economic devlopment projects that will be implemented within the next few years along the Springfield riverfront that could be integrated into a broader urban-reach wide riverfront tourism and recreation initiative. The Basketball Hall of Fame will be expanded to a mixed use facility for an estimated $85-90 million. In addition to the Basketball Hall of Fame, a planned Tourist Information Center and the Connecticut River Walk and Bikeway will be located along the Springfield riverfront.

In some river reaches, like the Northampton Oxbow area, there is such high recreational use that user conflicts have become common, and recreational carrying capacity may have been reached or exceeded. If water quality improves on the Holyoke-Springfield urban river reach, increasing recreational opportunities there may reduce pressures on the Northampton-Oxbow reach.

In order to assess the potential for recreation-based economic activity, it is useful to examine the existing economic activity associated with marinas on the Northampton-Holyoke reach of the river, where water quality meets the fishable and swimmable standards. A 1993 survey *(Connecticut River 2020 Strategy,* 1993*)* by the Center for Economic Development at the University of Massachusetts had the following findings:

Table Twelve. Economic Activity in Marinas of the Connecticut River

Marinas Surveyed:	4
Total Revenues:	$31,000,000
Total Customers:	5,797
Total Power Boaters:	4,475
Total Jet Skiers:	260
Total Canoeists:	1,062
Total Employees:	96
Plans to Hire:	2 of 4
Plans to Expand:	1 of 4
Number of Slips:	436
Average Slip Rates:	$730

In addition to the $3.1 million expended at four marinas, there are considerable other additional recreation-related expenditures, for such items as fishing and boating equipment, food, transportation and other others which accrue to the local economy.

FRCOG participated with the Franklin County Chamber of Commerce in a study called *"Increasing Tourism to the Northern Tier: A Tourism Development Strategy for the Greater Franklin County Region."* Besides looking at the benefits of increased tourism in the region, it also considered the possible detrimental environmental impacts of tourism, such as increased noise and air pollution from increased traffic, and loss of natural areas to development of tourist sites, parking and second homes. The tourism study for Franklin County relies on small-scale, non-conventional forms of tourism designed to minimize environmental and sociocultural impacts. These include agri-tourism, nature, and eco-tourism, and cultural/arts that do not require major infrastructure development.

4.24 Agriculture

Agriculture, including dairy farming, forestry, "pick your own" operations, orchards, maple sugaring and nurseries, provides many benefits to the region in terms of open space, scenic landscapes, environmental quality and environmentally friendly industries.

The importance of agriculture in Massachusetts and the Pioneer Valley is evidenced by the following:

- Massachusetts is first in the New England region for agricultural cash receipts, at $530 million, despite the fact that only 14 percent of the region's farmland is located in the Bay State.

- Nearly $212 million is spent by farmers statewide on farm inputs such as feed, seed, livestock, fertilizer, electricity and fuel.

- There are 6200 farms in the state which preserve 570,000 acres of open space in the form of fertile, scenic and productive farmland.

- Thirty-three percent of the state's cropland is located in Franklin, Hampshire, and Hampden counties, totaling 77,690 acres.

- The state's food processing industry generates about $2 billion in revenue annually and employs nearly 19,000 workers.

(Source: Donahue Institute, University of Massachusetts)

The Department of Food and Agriculture's Farmland Viability program, headquartered in Lancaster, MA provides farmers with business plans and grant funding for agreeing to retain their land in active agriculture for a period of five to ten years. This program is distinct from the DFA's APR program, although farmers who participate in the farmland viability program may later enroll their property in the APR program.

4.3 STRATEGIES FOR LAND USE, GROWTH AND ECONOMIC DEVELOPMENT

Strategy #14 (Land Use): Promote "Smart Growth" in the watershed.

Urban sprawl is the pre-eminent environmental problem in the United States, and in the Connecticut River watershed. For example, in the Pioneer Valley region alone, 34,000 acres of land have been developed for urban use from 1952 to 1985, while population growth remained modest. The impacts of sprawl include the increases in impermeable surfaces and urban stormwater runoff, increased non-point source pollution, loss of open space, river connectivity, public recreation access and riparian buffers and many other negative environmental impacts.

Smart growth is an alternative to sprawl that promotes compact growth in and around existing urban centers, along with preservation of open space and environmental quality. The smart growth concept is supported in the Connecticut River watershed by regional plans prepared and adopted by PVPC and FRCOG. In the PVPC region, *Valley Vision, The Regional Land Use Plan for the Pioneer Valley* is a comprehensive regional strategy designed to help communities plan effectively to control sprawling growth and promote more compact development in order to preserve the region's quality of life. FRCOG has completed a regional open space plan with similar objectives. These plans recommend specific community actions on smart growth.

Recommended Actions:

47) **Identify the Connecticut River as a model or pilot for a Smart Growth initiative.**
Seek financial resources, possibly through the American Heritage Rivers Initiative, to take a watershed-based approach to implementing smart growth strategies in individual communities. Many of these strategies have already been developed, with model bylaws, in *Valley Vision*.

48) **Promote compact growth in an around existing urban centers.**
Preventing urban sprawl requires pro-active steps by communities to designate areas where growth should occur, and changing zoning requirements to allow more compact growth. Provide technical assistance to communities in developing zoning and land use controls to promote compact residential and commercial development in or near existing downtowns, town or village centers, or designated growth centers.

Strategy #15 (Land Use): Preserve the Rural Character of the Watershed by Planning Development Based on an Understanding of Natural Resources.

Preventing pollution by wise planning is by far the least expensive and most effective way to protect a town's waterways. A working knowledge of a town's natural resources is critical to guide appropriate development. A natural resource inventory is an essential first step. Identifying important natural resources and setting protection priorities provides a framework within which the impacts of proposed or existing development can be evaluated. Formal inclusion of these priorities in town plans and procedures is also important as they provide a firm science-based foundation that will help withstand political and legal challenges. Resource protection strategies should be adopted, such as buffer zones, setback requirements and limits on impervious surfaces in sensitive areas.

Recommended Actions:

49) **Work with towns to develop or update their open space plans.**
By establishing a system of protected open spaces we determine where growth and development should occur. Many towns need financial and technical help with the development of open space plans. In Franklin County, for example, only one town has a current and accepted plan

(Sunderland), and it expired in October 1999. Current Open Space Plans are a prerequisite to qualifying for state Self-Help matching grants for open space protection.

50) **Create watershed-based open space plans.**
While some communities have existing open space plans, they may not reflect the importance of regional or watershed connections that serve important functions such as wildlife corridors and water quality protection. An open space plan developed at the watershed level would:
- develop a network of green spaces that protect the watershed landscape and natural infrastructure;
- provide close-to-home recreation opportunities;
- buffer unique resources and improve our experience as we move through the land.

FRCOG is presently working on a Regional Open Space Plan. They are interested in linking permanently protected open space and recreation area with other important features such as endangered species, habitat, scenic vistas, farmland, and aquifer protection areas.

51) **Update and improve regional and watershed Geographic Information System data layers (land use, wetlands, and protected open space)**
To assist communities with a wide range of planning efforts, including open space planning, there is a need provide communities and watershed groups with accurate information about land use.

Strategy #16 (Land Use): Improve Stormwater Management in Watershed Communities.

Standard land development can drastically alter waterways. Increased stormwater runoff associated with development can start a chain of events that includes flooding, erosion, stream channel alteration and ecological damage. Combined with an increase in man-made pollutants, these changes in waterway form and function result in degraded systems no longer capable of providing good drainage, healthy habitat or natural pollutant processing. Local officials interested in protecting town waters must go beyond standard flood and erosion control practices and address the issue of polluted runoff through a multilevel strategy of planning, site design and stormwater treatment. Stormwater policies, practices, and BMP options are described in DEP's Stormwater Policy Manual. The new federal Phase II Stormwater regulations require that communities adopt stormwater management Best Management Practices.

Recommended Actions:

52) **Assist community boards with the review and regulation of development to improve stormwater management.**
Regional planning agencies should work with municipal officials to tailor and adopt model stormwater management bylaws. A good model bylaw is contained in *Cleaning the Waters* (PVPC, MAPC, MVPC, 1994).

53) **Minimize development impacts through better site design.**
The site planning stage offers the best chance for local officials, designers and builders to work together to reduce polluted runoff from a site. Communties should evaluate site plans to minimize both impervious areas and disruption of natural drainage and vegetation. Better site design practices include;

- Cluster development, which reduces the total area of paved surfaces and increases open space, should be encouraged;

- Proposed sidewalks, roads and parking lot sizes should be no larger than absolutely necessary;

- Brick, crushed stone or pervious pavement is often a viable alternative to pavement in low traffic areas;

- Drainage should be directed to vegetated swales, where appropriate, rather than relying on curbing and piping to reduce runoff or enhance infiltration;

- Designs which reduce grading and filling and retain natural features should be encouraged. In addition to protecting waterways, such designs can often be less expensive and more pleasing to the eye.

54) **Mitigate unavoidable impacts by using Best Management Practices.**
Best management practices (BMPs) include a whole range of methods designed to prevent, reduce or treat stormwater runoff. Choosing the correct BMP is often highly site-specific. Some basic BMP concepts include:

- Slow the stormwater. This is the basic idea behind both detention basins, which are meant to slow and hold stormwater before releasing it and retention basins, which are designed to hold the water permanently until it infiltrates;

- Avoid direct connections. Break up the "express way" of polluted runoff by using grass swales, filter strips or other firms of vegetative BMPs wherever possible in place of curbing and piped drainage. In many cases, these are most effective when used in combination with structural BMPs like detention ponds;

- Ensure regular maintenance. Most structural BMPs require regular maintenance to retain peak pollutant-removal efficiency;

- Enforce and Educate. It's important to make sure that contractors are following through on agreed-upon designs and methods. Activities like storm drain stenciling and hazardous waste disposal days can reduce pollution, raise public awareness and help to engender support for local water protection activities. Sponsor workshops and training sessions on stormwater management for local boards and officials (such as the NEMO, or Nonpoint Source Education for Municipal Officials program developed by UConn Cooperative Extension).

Strategy #17 (Land Use): Identify and protect valuable open space in the watershed.

Protect open space and working farms, large tracts of forests and a diverse landscape through the acquisition of lands or conservation restrictions, using programs such as Self-help, Agricultural Preservation Restrictions, Forest Legacy, land trusts, town open space funds, and similar approaches.

Recommended Actions:

55) **Secure federal TEA-21 Enhancement grants and state transportation bond funds to acquire farmland (APRs) within the viewshed of highways and scenic byways to help preserve rural character.**
For example, DEM and the Department of Food and Agriculture received two grant awards totaling $800,000 for scenic land acquisitions along the Connecticut River Scenic Farm Byway under the ISTEA Transportation Enhancements Program.

56) **Encourage communities to adopt the provisions of the Community Preservation Act.**
The Community Preservation Act, which was enacted on December 14, 2000, enables communities the local option to establish a property tax surcharge of 0-3%, to be used by cities and towns to help shape their destiny through preserving open space, historic buildings and landscapes, and affordable housing. State matching grants of up to 100% are available to participating communities. It is a voluntary program allowing any community to vote to establish a fund. Communities must place CPA on the ballot at a local or state election and it must be approved by a majority vote, in order to take effect. To date, three communities in the watershed have approved a CPA property tax surcharge, including Amherst, Southampton and Hampden.

57) **Sponsor workshops and training sessions for land trusts on non-profit grant writing for open space acquisition and capacity building.**

Strategy #18 (Land Use): Promote and Facilitate Brownfields Redevelopment.

Brownfields are abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination. Redevelopment of these sites has many benefits including: increased job opportunities and tax revenue in urban areas, decreasing development pressure on "greenfield" sites, and a reduction in the use of natural resources. A number of incentives could be offered to encourage Brownfields redevelopment, such tax reductions and streamlining permitting procedures.

Recommended Actions:

58) **Create an inventory of brownfields sites in the region that may offer opportunities for redevelopment. The Pioneer Valley Planning Commission received funding from EPA to conduct a Brownfields Assessment Demonstration Pilot that will:**
- develop an Internet-accessible inventory of known brownfields sites in a geographic information system (GIS);
- create a monitoring and reporting system within the GIS to track the region's brownfields cleanup and redevelopment projects on an ongoing basis;
- develop a list of key site characteristics for different types of properties and establish criteria to identify priority brownfield sites.

The Franklin Regional Council of Governments is actively involved in brownfields identification and redevelopment. They were recently approved for an EPA "Rural Brownfields Cleanup Revolving Loan Fund" project for $1 million, which includes redevelopment of the Greenfield Tap & Die site in Greenfield.

59) **Provide technical and financial assistance to assess and address environmental contamination at selected sites.**
PVPC will serve as the lead agency in a four member coalition to bring funds to the region to

support the clean up of brownfields in support of economic development. The Commission, in collaboration with the Cities of Springfield, Chicopee and Westfield, will receive $2,000,000 to establish a revolving loan fund. The three communities will be eligible for up to $500,000 each with remaining funds available to the other 40 communities in the PVPC region. Fund repayments will be used to sustain the fund and finance additional eligible projects.

60) **Develop a model for a regional brownfield industrial park.**
As part of an EPA pilot brownfields project, PVPC will identify and document the steps required to develop a brownfield site.

Strategy #19 (Land Use, Economic Development): Promote environmentally sustainable economic development, such as tourism and agriculture.

Examples of untapped economic expansion sectors include tourism and agriculture. Tourism and agriculture are both diverse activities that can be pursued in an environmentally sustainable manner, and have the capacity to generate spin-off enterprises.

Recommended Actions:

61) **Seek Designation of a National Heritage Corridor for the Connecticut River Corridor.**
The Connecticut River corridor in Massachusetts has many outstanding natural, cultural, historical, scenic, aesthetic and recreational resources which are worthy of national recognition. The proposed National Heritage Corridor should extend along the main stem from Hartford, CT to Springfield to Northfield, with a particular focus on three key sites in Massasachusetts: Turner's Falls in Montague, Hadley Falls in Holyoke/South Hadley, and Springfield. Federal legislation should be adopted to authorize the National Heritage Corridor, and provide local funding, via the National Park Service, to initiate the project.

62) **Secure National Park Service grants and technical assistance for Heritage Corridor Implementation Projects**
Implementation projects could include:
- Creating a Connecticut River Heritage Trail, including a riverside walking and biking trail and an auto tour described in a map/guidebook.
- Conserving sensitive archaeologic and scenic heritage sites through acquisition.
- Preserving and restoring historical heritage sites for tourism.

63) **Develop alternative funding mechanisms for heritage tourism planning and development.**
Potential funding mechanisms include:
- creating and licensing a corridor theme icon for use in T-shirts, hats, and other souvenir items;
- tax increment financing;
- Community Development Block Grants;
- heritage-oriented business improvement districts

64) **Promote agricultural tourism within an expanded Connecticut River Scenic Farm Byway.**
The *Connecticut River Scenic Farm Byway Corridor Management Plan*, completed by Franklin Regional Council of Governments and Pioneer Valley Planning Commission in 1998 led to the creation of a scenic byway in the Franklin County communities of Sunderland, Montague, Erving and Northfield. The byway should be expanded to include Hadley and South Hadley. The following steps should be taken to promote agricultural tourism:
- Establish a public education program for the Byway in coordination with the Hadley Farm Museum, Porter Phelps Huntington House, Northfield Mountain Environmental Center and local libraries and historic commissions.
- Provide visitor information centers, including public restrooms, at designated waypoint communities.

65) **Support increased funding for the APR program**
The funding for the purchase of agricultural preservation restrictions is limited by annual capital spending caps on bonded indebtedness. Stakeholders should lobby for increases in funding when there is competition for surplus money.

Strategy #20 (Land Use, Economic Development): Identify a location and process for developing an "eco-industrial" park.

Undertake a study to determine the feasibility of siting an "eco-industrial park" or environmental incubator industry in or near the region's urban core. The eco-industrial park would serve as a demonstration model, open to the public, for sustainable development practices, such as green building materials, energy and water conservation, recycling, source reduction, and stormwater management.

Recommended Actions:

66) **Conduct an outreach and inventory process to identify appropriate sites (brownfields, redevelopment sites, etc.) for location of a green facility.**

Identify potential owners, tenants, and development entities for the facility.

- Develop sustainability criteria for potential development to include a wide range of environmental and social factors, such as energy efficiency, water conservation, air quality, material recycling, stormwater management, site design that incorporates habitat protection and connections, access to environmentally friendly transportation (bicycle, bus, train, pedestrian), employment training, disadvantaged communities, and use of existing infrastructure.

- Identify development financing strategies such as Tax Increment Financing (TIFs), bonds, non-profit foundation and government grants, and any other financing approaches to implement the project.

- Identify all actions required to implement the development of an environmental incubator industry site.

- Develop a public-private partnership to sponsor and undertake the project.

5.0 PUBLIC ACCESS, RECREATION AND GREENWAYS

5.1 PUBLIC RESPONSE AND PARTICIPATION

PRIORITY PUBLIC ACCESS GOALS

Based on a Watershed Survey of civic leaders in all Massachusetts communities in the Connecticut River main stem watershed, the most important **goals for public access, recreation and greenways** for the Connecticut River are (ranked in order of priority):

1) **create connected greenways and trails;**
2) **expand the purchase of development rights to to protect farmland and open space;**
3) **clean up and improve the visual aesthetics of the riverbank;**
4) **improve management of recreation thoughout the watershed;**
5) **strengthen agricultural viability along the river;**
6) develop additional public access to the river;
6) identify ways to prevent recreational use conflicts on the river;
8) promote the river as a destination point for tourism.

PRIORITY PUBLIC ACCESS PROBLEMS

The most significant **problems related to public access, recreation and greenways** identified by civic leaders are as follows (ranked in order of priority):

1) **lack of connected greenways of protected open space and wildlife corridors;**
2) **lack of public access facilities, such as public lands, bikeways and walking paths along the river;**
3) **over-use of some river sections for water-based recreation;**
4) degraded riverbank areas, filled with trash and dumped waste;
5) impairment of recreational uses, such as fishing and swimming, due to poor water quality;
6) recreational use conflicts on the river,

Based on the "Connecticut River Watershed Public Brainstorming Session" held 11-14-98 in Hadley, MA, the following issues were identified as top priority public access and greenway concerns for residents of the watershed:

1) Address impediments to recreation and tourism access, including inadequate river flow levels from Holyoke to Enfield, combined sewer overflows and water quality concerns, odor problems, carrying capacity of river, enforcement issues with increased traffic. Suggested actions included:
   - find ways to increase navigability of the river;
   - work with utility companies to provide adequate minimum flows from hydropower dams during peak generation periods;
   - coordinate river access, management and enforce ment better among state agencies, municipalities, marinas and river users;
   - develop a coordinated emergency response system;
   - work with enforcement personnel to better handle increased traffic on the river, with combination of state and local enforcement and assistance from volunteer River Rovers;
   - develop a voluntary group of river stewards to protect the river.

2) Improve the visual quality of riverfront areas. Suggested actions included:
   - restore degraded streams and riparian buffer areas

3) Improve river access, by providing public access areas and facilities, eliminating constraints to access, improving safety, cleaning up litter and reconnecting cities to the river. Suggested actions included:

- reconnect riverfront cities and towns with rivers and streams;
- investigate property ownership, develop greenways and trails;
- build access over railroad track when possible.

4) Litter and erosion at public access areas and boat access ramps. Suggested actions included:
   - provide better facilities for trash and boat "pump-out" stations

5.2 ASSESSMENT OF THE CURRENT SITUATION

5.20 Recreation

Recreational use of the upper Connecticut River has increased in tandem with improvements in water quality since 1972. With the exception of organics, such as PCBs, water quality in the Massachusetts section north of the Holyoke dam now meets Class B water quality standards, and is increasingly used for recreational pursuits that involve contact with the water, such as power boating, kayaking, canoeing, swimming and fishing. These recreational uses are concentrated in the river sections above the Holyoke Dam, to the point where the Holyoke Pool-Northampton Oxbow segment of the river is suffering from overuse. There is also a strong interest in riverfront development in this stretch of the river.

In a 1997 recreational use study completed for the Holyoke Dam relicensing, consultants conducted a study to determine the extent of recreational river usage. During the summer, the reach of the river from Sunderland to South Hadley had, on average, 204 water craft per day, or a range of 22 to 438 water craft. Total recreational use of this river segment for the month of August was 35,498 recreation days, including 38% motor boating, 26% boat fishing, 10% fish viewing, 9% camping, 7% picnicking/sightseeing, 4% bank angling, 2% swimming, 2% cartop boating, and 2% jetskiing. Sections of the northern reach are over 100% of the estimated carrying capacity and are thus significantly over-used. This suggests that there will be a significant demand for recreational use in the lower reach if water quality improves to allow usage analogous to that of the northern reach. Currently, however, recreational use of the reach below the Holyoke Dam is limited primarily to power boating and fishing due to the presence of combined sewer overflows (CSOs) that convey raw sewage and stormwater into the river elevating bacterial counts to unsafe levels. For this reason, it is particularly important to eliminate dry weather overflows, so that recreational use could be encouraged during dry weather on the lower Connecticut River.

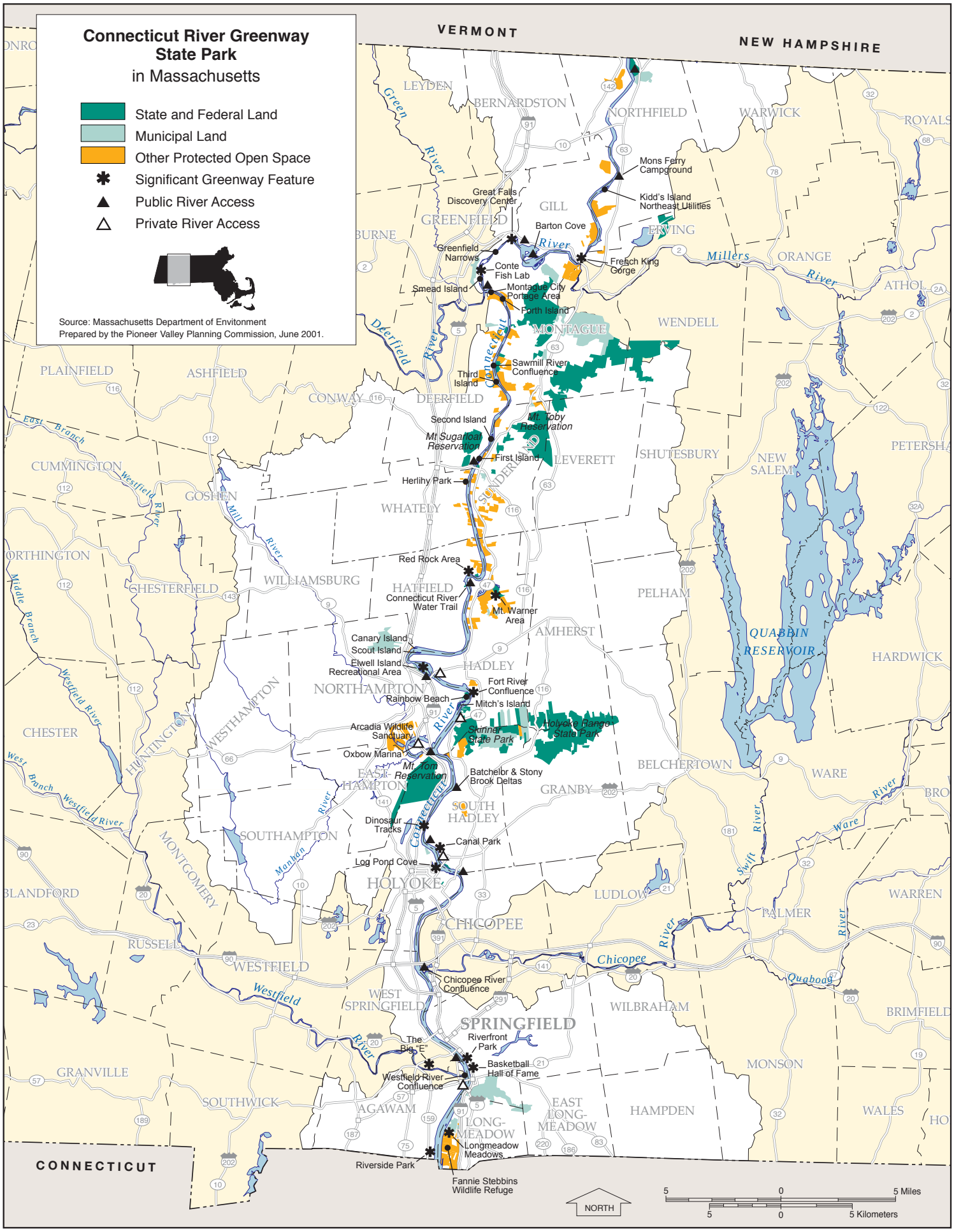
Recreational opportunities to use the river will be enhanced by improving the water quality of the river below the Holyoke dam. This may also alleviate access pressure in the northern reach by providing additional outlets along the river. Separating or otherwise remediating the 134 combined sewer and stormwater outfalls located in the communities of Agawam, Chicopee, Ludlow, Holyoke, Springfield, South Hadley, and West Springfield will dramatically improve water quality below the Holyoke Dam. However, CSO clean-up will be an expensive operation that will be implemented over a long period of time. In the meantime, there are several implementation strategies, described below, that can be employed in the short-term to improve public access to the river in the urban core areas, thereby expanding recreation and tourism opportunities within the riverfront corridor.

5.21 Public Access

The lack of adequate public access in the urban stretches of the river has been identified as a critical issue. There are several projects in the engineering or construction phase of implementation that are anticipated to stimulate demand for river use in the southern, urban segment of the river. For example, the Connecticut RiverWalk and Bikeway is an 18-mile pedestrian and bike-trail that was designed to link the six riverfront communities of Agawam, Springfield, West Springfield, Chicopee, Holyoke and Longmeadow. This estimated $8.1 million project is being implemented in stages, but has been slowed due to reductions in Federal Highway Department TEA-21 (formerly ISTEA) funding. While the Connecticut RiverWalk and Bikeway will increase public access to the river, there is clearly a further need to improve and increase safe public access points and reconnect the river and urban communities. Improved public access will increase public awareness of river pollution issues, and may help to increase political and financial support for river clean-up efforts.

5.22 Greenways

Various governmental agencies could play a role in the establishment of a watershed-wide greenways network, either through providing management, technical assistance in acquisition, or funding opportunities, such as DEM's Greenways grant program. Some of the communities, such as Springfield, have local parks and recreation departments charged with management and maintenance of public parks. The Mass. Department of Environmental Management is responsible for the management of state-owned park land, and operates the Massachusetts Greenways program out of the Connecticut River Greenway State Park office in Northampton, Massachusetts. At the federal level, the National Park Service is responsible for preserving recreational, cultural, and historic sites of national interest.


Connecticut River Greenway State Park
in Massachusetts
State and Federal Land
Municipal Land
Other Protected Open Space
Significant Greenway Feature
Public River Access
Private River Access
Source: Massachusetts Department of Envitonment
Prepared by the Pioneer Valley Planning Commission, June 2001.
VERMONT
NEW HAMPSHIRE
CONNECTICUT
Mons Ferry Campground
Kidd's Island Northeast Utilities
Great Falls Discovery Center
Barton Cove
Greenfield Narrows
Conte Fish Lab
French King Gorge
Smead Island
Montague City Portage Area
Forth Island
Sawmill River Confluence
Third Island
Second Island
Mt. Sugarloaf Reservation
Mt. Toby Reservation
First Island
Herlihy Park
Red Rock Area
Connecticut River Water Trail
Mt. Warner Area
Canary Island
Scout Island
Elwell Island Recreational Area
Fort River Confluence
Rainbow Beach
Mitch's Island
Arcadia Wildlife Sanctuary
Skinner State Park
Holyoke Range State Park
Oxbow Marina
Mt. Tom Reservation
Batchelor & Stony Brook Deltas
Dinosaur Tracks
Canal Park
Log Pond Cove
Chicopee River Confluence
The Big "E"
Riverfront Park
Basketball Hall of Fame
Westfield River Confluence
Longmeadow Meadows
Riverside Park
Fannie Stebbins Wildlife Refuge
Quabbin Reservation
Quabbin Reservation
Green River
Deerfield River
Connecticut River
Millers River
East Branch Westfield River
Middle Branch Westfield River
West Branch Westfield River
Mill River
Manhan River
Ware River
Swift River
Chicopee River
Westfield River
Quaboag River
LEYDEN
BERNARDSTON
NORTHFIELD
WARWICK
ROYALSTON
GREENFIELD
GILL
ERVING
ORANGE
ATHOL
WENDELL
MONTAGUE
PLAINFIELD
ASHFIELD
CONWAY
DEERFIELD
LEVERETT
SHUTESBURY
NEW SALEM
PETERSHAM
CUMMINGTON
GOSHEN
WHATELY
SUNDERLAND
ORTHINGTON
CHESTERFIELD
WILLIAMSBURG
HATFIELD
PELHAM
AMHERST
QUABBIN RESERVOIR
HARDWICK
HADLEY
NORTHAMPTON
WESTHAMPTON
CHESTER
HUNTINGTON
EAST HAMPTON
SOUTH HADLEY
GRANBY
BELCHERTOWN
WARE
SOUTHAMPTON
MONTGOMERY
HOLYOKE
LUDLOW
PALMER
WARREN
BLANDFORD
RUSSELL
WESTFIELD
CHICOPEE
WEST SPRINGFIELD
SPRINGFIELD
WILBRAHAM
BRIMFIELD
MONSON
GRANVILLE
SOUTHWICK
AGAWAM
LONG-MEADOW
EAST LONG-MEADOW
HAMPDEN
WALES
NORTH
5 0 5 Miles
5 0 5 Kilometers

5.3 STRATEGIES FOR PUBLIC ACCESS, RECREATION AND GREENWAYS

Strategy #21 (Public Access, Recreation): Continue and Support the Establishment of a Network of Greenway Corridors.

Greenways can serve a number of functions, including providing wildlife migration corridors through urban areas, connecting isolated pockets of green spaces, and providing opportunities for recreational activities such as walking and biking. In addition, a vegetated riparian corridor serves as a buffer, filtering out and trapping contaminants before they reach the water resource. They also provide recreational opportunities to area residents and visitors, and enhance wildlife habitat by linking existing separated open spaces. PVPC's *Connecticut River 2020 Strategy* recommends a regional greenway along the Connecticut River, linked together by the Connecticut Riverwalk and Bikeway. FRCOG is working on identifying regional greenway corridors within their Regional Open Space Plan.

Recommended Actions:

67) **Develop a regional network of greenways along the Connecticut River and its tributaries.**
The Appalachian Mountain Club, under contract to DEM, is developing a Statewide Greenway Plan which will show existing conditions and present a vision for future greenway connections. This plan should be reviewed and supported, where appropriate, by the Basin Team. The PVPC *Connecticut River 2020 Strategy* and the FRCOG regional open space plan also describe components of this regional greenway network.

Strategy #22 (Public Access): Use the river as a tourism destination point and an agricultural economic development tool.

Recommended Actions:

68) **Support the completion of design and construction plans for the Connecticut River Walk and Bikeway**
- Create a strong network of project supporters to pursue release of previously awarded grant funds from Mass. Highway Department under the TEA-21 program.

- Seek additional funds under state budget bills or state transportation bonds or TEA-21 for construction of River Walk segments under design.

- MHD has awarded funding totaling $8.3 million for design and construction of River Walk segments in Springfield, Agawam, Holyoke, Chicopee, and West Springfield. However, much of this funding has not been released. Additional construction funding needs total $2-6 million.

69) **Support the development of the Franklin County Bikeway**
The Franklin County Bikeway is a network of over 40 miles of off-road and shared roadway facilities designed to provide alternative transportation connections to many destinations throughout Franklin County and its adjoining regions. The Bikeway travels throughout the flatter lands in the towns adjacent to the Connecticut River. The first segments of the proposed bikeway should be in place by the year 2000.

70) **Develop a valley-wide tourism program.**
The Connecticut River Valley (including major tributaries) could be promoted to reach an audience via a website, maps, and signage. Such promotional materials could provide linkages to the various attractions within the watershed (e.g., American Precision Manufacturing Corridor, Great Falls Discovery Center, Connecticut River Greenway State Park, Robert Frost and Metacomet-Monadnock Trails, Audubon Sanctuaries, Hitchcock Center, Laughing Brook Nature Center, Arcadia, Northfield Mountain Environmental Center, Trustees of Reservations sites).

71) **Promote farms (farm stands, farm stays, etc.) as tourist destinations to help strengthen the viability of family farms.**
The Connecticut River Scenic Farm Byway project, coordinated by FRCOG and PVPC, recommends a series of strategies to promote farm-related tourism along the scenic byway, which includes Routes 47 and 63. (This project is described in greater detail on p. 70).

Strategy #23 (Public Access): Enhance the visual aesthetic of the Connecticut River in urban areas.

Some urban riverbank areas along the Connecticut River have been degraded over the years by trash, dumped refuse, extensive riprapping, abandoned vehicles, and areas of pavement destroying natural riparian habitat.

Recommended Actions:

72) **Organize annual trash clean-up days.**
Good examples of river clean-up days are the Connecticut Source to the Sea Cleanup and the Westfield River Cleanup sponsored by the Westfield River Watershed Association. The support of civic organizations (such as churches, Boys and Girl's Clubs, Kiwanis, Rotary, etc.) should be enlisted for this effort.

Strategy #24 (Public Access): Balance increased water related activities and interests with environmental concerns.

There is a need to develop programs to minimize conflicts between river users (i.e. power boaters and paddlers), such as river zoning. There is also a need for programs to reduce litter and trash generated by river users, including educational signage and "adopt-a-river" litter clean-up programs.

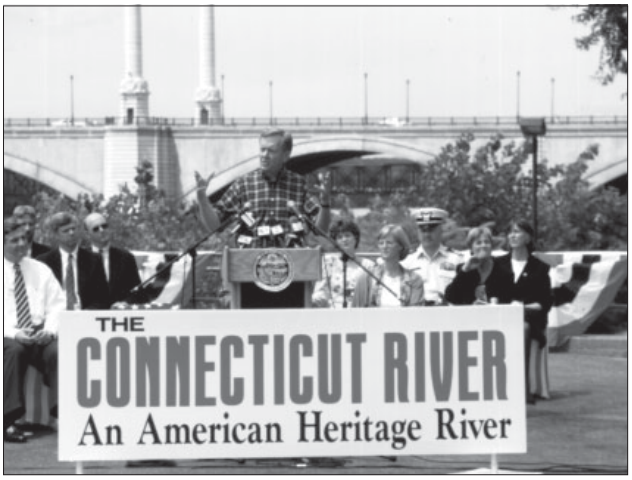
On the Connecticut River at Rainbow Beach, there has been a problem with unauthorized camping and other extensive recreational use of the beach, which threatens habitat for the endangered Puritan Tiger Beetle. There is a need for continuing education, signage, River Rovers or other means to minimize the impact of recreational use on the beetle and its habitat.

Recommended Actions:

73) **Identify and evaluate options to reduce the adverse impacts of over-use of the river, either through expanding recreational opportunities elsewhere, or through more stringent enforcement of speed limits to reduce conflicts among users.**

74) **Work with the Public Access Board to develop additional public access sites to the Connecticut River, particularly for universal access.** Develop and enhance public access to new sites, with a strong sensitivity to resource protection.

75) **Identify and facilitate access to additional recreation sites on tributary streams.** Many tributary streams have excellent warm and coldwater fisheries and areas that are underutilized for paddling and swimming opportunities.



6.0 COORDINATION AND WATERSHED MANAGEMENT PARTNERSHIPS

6.1 ASSESSMENT OF THE CURRENT SITUATION

The Connecticut River watershed has been segmented by organizations in a variety of ways. For example:

- Mass. Department of Environmental Management (DEM) has a "Watershed Connections" program that divides the watershed into two areas – the Berkshire Region and Connecticut River Valley Region. DEM also has the Connecticut River Greenway State Park, which has been created to improve the management of state lands along the main stem, and divides the river into Reaches I-IV which define its water trail from Vermont to Connecticut;
- Lands owned by the Commonwealth are managed under separate agencies – DEM (Forests and Parks Division), Division of Fisheries and Wildlife, and Department of Food and Agriculture (which holds Agricultural Preservation Restrictions) – creating interagency land conservation issues.
- Hampden, Hampshire and Franklin Counties are units of management for Conservation Districts in Massachusetts;
- Two Regional Planning Commissions – the Pioneer Valley Planning Commission (Hampshire and Hampden County) and Franklin Regional Council of Governments – are responsible for economic, environmental, and transportation planning in the Massachusetts portion of the watershed covering the three county area;
- The Massachusetts Watershed Initiative itself seg ments the overall Connecticut River watershed into the Chicopee, Westfield, Millers, Deerfield and Connecticut River watersheds, all of which have separate basin teams.

It is difficult for these management divisions to coordinate their efforts and work cooperatively to implement each other's plans, let alone integrate them into the Watershed Initiative for the Connecticut River as defined by the Commonwealth. There may even be a duplication of efforts. Uncoordinated or duplicative programming and multiple jurisdictions and divisions within the watershed affect agency and nonprofit management and protection of the River and make it difficult for stakeholders to get involved in protecting the watershed ecosystem. It is sometimes unclear who to approach to discuss issues and concerns or who to contact to solve a problem.

6.2 STRATEGIES FOR WATERSHED MANAGEMENT

Strategy #25 (Coordination): Integrate the five-year cycles, work, and plans of the five major tributary basins – Farmington, Westfield, Deerfield, Millers, Chicopee – and the Connecticut River.

The Massachusetts portion of the greater Connecticut River Watershed includes the sub-basins of the Farmington, Westfield, Deerfield, Millers and Chicopee Rivers. The size, scale and diversity of issues of these watersheds require that each river have Team Leaders and Watershed Teams. Yet, having disparate five-year cycles, management programs, and work plans in each basin is not conducive to implementing a cost effective and coordinated management program for the entire Connecticut River watershed. Additionally, each of the Watershed Team Leaders has specific expertise that could benefit their watershed as well as the other watersheds in the MA portion of the Connecticut River watershed.

The five Watershed Team Leaders should continue to meet on a monthly basis to ensure integrated watershed management for all of the Connecticut River watershed in Massachusetts. They should discuss integrating their

Table Thirteen. Watershed Stakeholders

Stake'hold'er, n., 1. Thr holder of the stake of a wager. 2. A person or group that has an investment, share, or interest in something, as a business or industry. 3. Law. A person holding money or property to which two or more persons make rival claims.

Used in the context of the Watershed Initiative, a stakeholder is a person or group that shares a concern for the future of the watershed.

Local Communities	Regional	State	Federal
• Planning Boards • Conservation Commissions • Health Boards • Elected Officials • Historic Commissions • Water and Sewer Departments • Winding River land Trust (Westfield)	• Connecticut River Watershed Council • Land Trusts (Valley Land Fund, Kestrel Trust, Franklin Land Trust, Hilltown Land Trust, Mount Grace Trust Rattlesnack Gutter Trust) • Pioneer Valley Planning Commission • Franklin Regional Council of Goverments	• Executive Office of Environmental Affairs • Department of Environmental Management • Department of Fisheries, Wildlife, and Environmental Law Enforcement (DFWELE) • Department of Environmental Protection	• United States Environmental Protection Agency • National Park Service • United States Fish and Wildlife Service (Conte Wildlife Refuge) • USDA Natural Resources Conservation Services • U.S. Army Corps of Engineers
Private Sector	**Educational**	**Subwatershed Organizations**	**Other Organizations**
• Business • Industry • Agriculture • Landowners • Citizens	• University of Massachusetts • Smith College • Hampshire College • Mt holyoke College • Amherst College • Hampshire College • Greenfield Community College • Holyoke Community College • Springfield College • Springfield Technical Community College • Other area colleges	• The Mill River Partnership • Friends of the Manhan River • Greater Springfield Area Riverwatch (GSAR) • The Sawmill River Alliance • Bennet Brook • Broad Brook Coalition	• Massachusetts Water Watch • Partnership • University of Massachusetts Cooperative Extension Service • Franklin, Hampshire Hampden, Conservation District • Trout Unlimited • The Nature Conservancy • American Farmland Trust

work plans; decide on roles and responsibilities for carrying out the five-year watershed management cycles in each of the six sub-basins; and work in partnership to implement the watershed management approach.

Strategy #26 (Coordination): Develop a River Corridor Management Plan(s) with the 19 riverfront towns along the main stem of the Connecticut River and the riverfront towns along the Farmington, Westfield, Deerfield, Millers and Chicopee Rivers.

To paraphrase former House Speaker "Tip" O'Neill, "all conservation is local." We need the involvement, assistance and commitment of the riverfront communities to effectively protect the Connecticut and its tributaries. Each of the six Connecticut River sub-basins needs a River Corridor Management Plan like that in Vermont and New Hampshire, which would serve as a guidance document for federal, state and local action to protect the Connecticut River ecosystem.

A partnership of the Connecticut River Watershed Council, Pioneer Valley Planning Commission, Franklin Regional Council of Governments and riverfront towns should work together with MA EOEA to fashion a regional "Communities Connected by Water" grant that would result in a River Corridor Management Plan for the six rivers.

6.3 RELATED PLANS, PROGRAMS AND INITIATIVES

There are many organizations working effectively in the Connecticut River watershed on a broad range of issues. A description of plans, programs and projects related to the Strategic Plan is included here in order to provide greater an understanding of the larger picture of watershed management.

6.30 Programs on Greenways, Byways and River Protection

6.31 Connecticut Valley Action Program

The Massachusetts Department of Environmental Management, the Connecticut River Watershed Council, and the National Park Service spearheaded the development of a management plan for the 66 miles of the Connecticut River that flow through Massachusetts in 1984-85. With input from meetings in the nineteen river-bordering Massachusetts communities, local non-profit organizations, and private interests such as Northeast Utilities, a preliminary management plan was created to facilitate the development of the final management plan. Issues and concerns included topic areas such as agricultural land preservation, economic development, streambank restoration, tourism and recreation, and water quality improvement.

The Connecticut Valley Action program provides a framework for long-term planning, technical assistance and land acquisition in region. Periodically the program produces action plans, such as *An Action Plan for the Urban Reach of the Connecticut River; Rediscovering the River* (1987), *and An Action Plan for Scenic/Natural Reach of the Connecticut River* (1993). The Plans identify threats to resources, such as fisheries and cultural sites, and then recommends actions to mitigate the threat and protect and improve the resource quality. The program undertakes land acquisition and resource conservation efforts throughout the Massachusetts reach of the Connecticut River Valley. The program is coordinated by the Department of Environmental Management from the Connecticut River Greenway State Park offices in Northampton, MA. For more information contact Terry Blunt at (413)-586-8706.

6.32 Connecticut River Greenway State Park Management Plan

In 1997 the Department of Environmental Management (DEM) completed the final draft of the *Connecticut River Greenway State Park Management Plan*. Since 1985 DEM has been acquiring shoreland and parcels to create a contiguous greenway along the Connecticut River. In 1995, the Connecticut River Greenway State Park was created to coordinate the management of these river-corridor parcels.

The goal of the Park is habitat diversity protection, protection of cultural, historical, and environmental resources within the region, and provision of recreational and educational experiences for the public. The Plan identifies and describes the acquired parklands and recommends future actions to protect the resources from threats and direct acquisition efforts. Recommendations include increased signage regarding regulations to educate the public and enforcement of existing regulations, acquisition priorities, and kiosks to educate the public about resource issues.

6.33 American Heritage Rivers Initiative

In 1998 the Connecticut River was one of fourteen rivers in the United States designated as an American Heritage River by President Clinton. The award was the result of a four-state cooperative effort spearheaded by the Connecticut River Watershed Council. Other lead organizations were the Connecticut River Joint Commissions, Pioneer Valley Planning Commission, and Hartford Riverfront Recapture. The designation establishes a two-town deep riverfront area that will receive additional opportunities for federal technical

and financial assistance. The designation celebrates the rich historical and cultural linkages between the River and the rest of the watershed. In the Massachusetts reach of the Connecticut, the river winds through communities that reflect the industrial origins of the region, from Historic Deerfield and Turners Falls, to the Holyoke Canal and the Springfield Armory and Miracle Mile. In addition, the designation is concerned with preserving and enhancing the environmental quality of the river and its watershed, and pledges to coordinate federal agency action and funding to promote and protect the River. A River Navigator has been hired to coordinate and facilitate funding opportunities to enhance the river and its' bordering communities.

For more information regarding the American Heritage River designation contact the Connecticut River Watershed Council at Bank Row, Greenfield, MA, telephone (413)-772-2020.

6.34 Community Watershed Initiative

Recognizing that rivers and other natural resources cross political territories, the Connecticut River Watershed Council (CRWC) and the Housatonic Valley Association have launched this initiative to create a model multi-state watershed management program. The goal is to coordinate non-point source pollution (NPS) reduction programs across state borders. The project partners will also identify technical assistance resources available to local communities and nonprofit organizations through federal and state agencies in Connecticut and Massachusetts. The Community Watershed Initiative began in the fall of 1997, and is funded for two years.

6.35 Tri-County Connecticut River Scenic Farm Byway

In 1996 Massachusetts, New Hampshire and Vermont obtained funding from the Federal Highway Administration, Intermodal Surface Transportation Efficiency Act (ISTEA) to conduct a feasibility study regarding designation of a Connecticut River Scenic Byway. The study area extends from the Canada-New Hampshire border to South Hadley, Massachusetts, to a depth of one town on either side of the Connecticut River. The tri-state planning effort carried out a series of tasks to develop a Corridor Management Plan that would coordinate and identify cultural, historic and natural resource preservation opportunities while ensuring adequate transportation infrastructure existed to serve the region and capitalize on tourism opportunities. The study included inventories of natural and cultural resources, public outreach and involvement in issue-identification, review of local land use regulations, and an economic development assessment.

Recommendations from the study included improving scenic turnouts, increasing roadside interpretation of historical and cultural resources, and revitalizing the aesthetics of downtown riverfront areas. Collaboration among organizations operating within the byway study area should continue to strengthen implementation efforts. Economic development efforts should draw from the historical, cultural, and recreational resource opportunities of the byway, such as tourism, and could be cooperative efforts between the three states. Land acquisition and the development of natural resource management plans for the area will facilitate the conservation of the area.

6.36 Planning for a Special Place; An Action Plan for the Scenic /Natural Reach of the Connecticut River

The University of Massachusetts, Department of Landscape Architecture and Regional Planning (LARP) prepared this study for the Department of Environmental Management, in 1986. The project analyzed resource protection options and developed an implementation plan for Reach 2 of the Connecticut River, which extends from the Turners Falls Dam to the Coolidge Bridge (Route 9). Critical threats to the habitat and recreation viability of this stretch of the river include farmland conversion and shoreline development. The planning process involved inventorying and converting into a mapped form land ownership, natural and cultural resources, agricultural land, existing public access and recreational areas, zoning, floodplains, and lands protected under the Agricultural Preservation Restriction program (APR), or with a Conservation Restriction (CR).

The study created a profile of Reach 2, and determined that land holdings ranged from small parcels to extensive holdings, that 71 % of the land was actively farmed, and that approximately half of the private landowners permitted public access across their holdings. The study reiterated that this segment of the river is rich in wildlife and fish species, as well as cultural and historic resources such as identified Paleo-Indian sites and remnants from the colonial era. Recommendations include creating a Reach 2 River Protection District that would transcend political boundaries, a land acquisition priority list, and speed limits for motorboats, and education to raise awareness of the resource threats and opportunities along the River.

6.37 Recovering the Valley: An Environmental Status Report of the Connecticut River Basin 1970-1983

The objective of this 1982 report was to assess the environmental improvements of the Connecticut River Basin from 1970 to 1980. Undertaken by a team from

the University of Massachusetts- Amherst, the study determined that while environmental conditions had improved over the course of the decade and the expenditure of nearly $1 billion in public and private funds, there were still challenges to restore the Connecticut River. Issue areas identified by the team included acid rain, hazardous waste, recreation, land conservation, flood control, fish and wildlife restoration, and farmland preservation.

6.38 The Connecticut River Greenway Study

Conducted in 1984 by the University of Massachusetts, Amherst Department of Landscape Architecture and Regional Planning (UMASS-LARP) for the Department of Environmental Management and the National Park Service. The comprehensive assessment focused on six general resource areas; recreation use and river access, development restricted lands, natural resource habitat protection, water quality/pollution sources, cultural and historical resources and scenic resources. The study area encompassed the Massachusetts stretch of the Connecticut River Valley.

Recommendations derived from the inventories and assessments of the resource areas include land acquisition priorities for either conservation or recreational purposes based on an assessment of development, restricted lands, a ranking of recreational sites within the corridor, and natural resource habitat protection priorities. Combined Sewer Overflows (CSOs) and non-point source pollution are identified as the primary obstacle to attaining the fishable/swimmable goal for the River below the Holyoke Dam. Lack of sufficient data was identified as a significant issue with regards to water quality, particularly a lack of uniformity on collection methodology. Cultural resources were clustered and then ranked in terms of high and low importance.

6.4 PROGRAMS ON WATER QUALITY

For additional information on this category, please refer to the following programs, studies, and plans:

6.40 Lower Connecticut River CSO Study; Metcalf and Eddy

In 1988, Metcalf & Eddy, working for the Massachusetts Division of Water Pollution Control (DWPC), completed a $1 million, detailed engineering study to address the problem of combined sewer overflows in the communities of Agawam, Springfield, West Springfield, Holyoke, Chicopee, South Hadley and Ludlow. Water quality monitoring conducted for the study indicated "bacterial pollution and aesthetic impacts due to sewage solids and floatables, but no significant impacts on dissolved oxygen". The DWPC study provided recommendations for separating sewer lines and building screening and disinfection facilities at an estimated cost of $377 million.

6.41 Health of the Watershed; A Report of the Connecticut River Forum

In 1998 the Connecticut River Forum, a collaboration between the states of Massachusetts, Vermont, New Hampshire and Connecticut, the New England Interstate Water Pollution Control Commission (NEIWPCC), federal agencies, and other interested organizations completed this report identifying the main water quality issues and recommending viable solutions to these problems. The effort first identified critical issue areas, such as pathogen contamination from combined sewer overflows (CSOs), eutrophication from excessive nutrient loading, the introduction of toxic pollutants from industrial and stormwater discharges such as PCBs and mercury, NPS pollution, and habitat degradation.

Recommendations include a region-wide, watershed-based approach that examines cumulative impacts to water quality and quantity and focuses on pollution prevention rather than relying on expensive reactive clean-up efforts. Water quality monitoring is identified as one significant step to facilitating the identification of resource threats and thus addressing the source of the pollution. CSO abatement, NPS pollution control, and erosion and sediment control are additional recommendations the report discusses.

6.42 Interstate Coalition for CSO Clean-Up of the Connecticut River

In 1995 the U.S. Environmental Protection Agency (EPA) issued Administrative Orders to seven communities in Massachusetts, Holyoke, South Hadley, Chicopee, Springfield, West Springfield, Ludlow and Agawam, that have Combined Sewer Overflows (CSOs). The 134 CSOs identified through a 1988 study conducted by Metcalf and Eddy, Inc., in these communities convey raw sewage into the river after storm events. CSOs have been identified as the primary source of contamination in the reach of the River below the Holyoke dam to the Connecticut state border, and the principle obstacle to achieving Class B (fishable, swimable) standards.

The Interstate Coalition is comprised of representatives from federal, regional and private agencies such as the United States EPA, the Pioneer Valley Planning Commission, the Hartford Metropolitan District Commission, and the Connecticut River Watershed Council, among others. Established as mechanism to generate broad political support and obtain funding to address the enormous costs associated with CSO clean-up efforts, the coalition successfully lobbied for a $1.3

million dollar line item in the FY1999 federal budget. The funds were divided between four Massachusetts communities and Hartford, Connecticut. Eighty percent of the funding is devoted to the Massachusetts communities, with Hartford receiving the remaining twenty percent.

6.43 Connecticut River Clean-up Committee

The Connecticut River Clean-Up Committee is comprised of representatives from the seven Massachusetts communities under EPA Administrative Orders to address the negative water quality impacts to the Connecticut River from Combined Sewer Overflows (CSOs). The Committee is an action-oriented entity that determines how the funds obtained by the Interstate Coalition will be disbursed among the member communities. Funds received from the federal government to address CSOs will be allocated to the communities based on the priorities identified by the 1988 Metcalf and Eddy study. The Metcalf and Eddy study determined that 90 Percent of existing CSO discharges would need to be eliminated within the seven Massachusetts communities to achieve the fishable/swimable goal. The cost of this effort was estimated to be $377,115,200 in 1988.

6.44 Pioneer Valley Water Action Plan

The Pioneer Valley Planning Commission, under a Strategic Planning Grant from the Massachusetts Executive Office of Communities and Development, developed the *Water Action Plan* in 1990. The plan summarized local community and regional water supply demands and safe yields, and inventoried potential emergency inter-municipal water connections. The plan described several water demand reduction and conservation options for municipalities and businesses. Finally, the plan has regional water action strategies that should be implemented by communities.

6.45 The Water Supply Citizens Advisory Committee (WSCAC)

WSCAC, originally formed in response to a proposal to divert water from the Connecticut River, has developed considerable expertise in demand management, water conservation techniques, and other means to improve the efficiency of water supply systems. WSCAC's expertise can and should be tapped to assist municipal and other water suppliers in the watershed in upgrading their systems to improve efficiency in water delivery and use. (WSCAC can be reached at 138 Russell Street, P.O. Box 478, Hadley, MA 01035, (413) 586-8861. Members of WSCAC include Bill Elliott, Eileen Simonson, and Alexandra Dawson.

6.46 The Massachusetts Water Resource Research Center (MA WRRC)

WRRC can also help study the feasibility of various options for reducing the adverse impact of water supply withdrawals on aquatic and other water dependent ecosystems. For example, the WRRC could help determine which surface water and groundwater withdrawal points have the most direct impact on water levels in streams, streamside wetlands, and vernal pools. They could then determine the feasibility of changing existing water withdrawal locations and pumping rates to shift withdrawals to reduce the impact on the ecosystem. (Contact for the WRRC, Blaisdell House, University of Massachusetts, Amherst, MA 01003, is Dr. Joseph Larson (413) 545-5532.

6.5 PROGRAMS ON STREAM AND HABITAT PRESERVATION

The following plans, programs and studies are relevant to the category of stream and habitat preservation within the Strategic Plan.

6.50 Silvio O. Conte National Fish and Wildlife Refuge: Action Plan

Congress established the Conte National Wildlife Refuge, administered by the U.S. Fish and Wildlife Service, in 1991 (P.L. 102-212). The three-pronged mission statement encompasses three broad categories of outreach and education, habitat management, and land acquisition, and is to be implemented throughout the Connecticut River Watershed. The Conte Challenge Grant Program provides financial assistance for these activities.

6.51 Atlantic Salmon Restoration Plan

The Connecticut River Basin Atlantic Salmon Compact (Public Law 98-138) formalized the Connecticut River Atlantic Salmon Commission in 1983. The legislation charged the Commission with restoring Atlantic salmon to the Connecticut River. This legislation is currently proposed for re-authorization in the House and Senate (H.R. 2062 and S. 703).

The Connecticut River Atlantic Salmon Commission developed a revised *Strategic Plan for the Restoration of Atlantic Salmon to the Connecticut River* (July, 1998) to provide a summary of past and current Atlantic Salmon restoration efforts and a vision for focusing interagency restoration activities. Strategies were developed that address the challenges facing future restoration and are the next step to accomplishing the Program's mission: to protect, conserve, restore and enhance the Atlantic salmon population in the Connecticut River basin for the public benefit, including recreational fishing.

The Strategic Plan has six goals as follows:

1. Manage Atlantic salmon production to produce sea-run Atlantic salmon returns.

2. Enhance and maintain the quantity, quality and accessibility of salmon habitat necessary to support re-established spawning populations.

3. Protect Connecticut River salmon from exploitation.

4. Allocate adult Atlantic salmon to maximize benefits to the Program.

5. Assess the effectiveness of the Program by conducting monitoring, evaluation, and research and implement changes when appropriate.

6. Create and maintain a public that understands and supports salmon restoration efforts and participates whenever possible.

7. Improve administration and operations within the Program.

A Management Plan for American Shad in the Connecticut River Basin (1992) outlines seven management objectives (addressing return goals, exploitation, passage requirements, outmigrant survival, and recreational opportunities) to restore and maintain a spawning shad population to its historic range within the Connecticut River watershed.

6.52 Invasive Plant Control Initiative

The United States Fish and Wildlife Service, Silvio O. Conte National Fish & Wildlife Refuge, drafted this initiative in 1998, to address the issue of invasive plant species within the Connecticut River watershed/ Long Island Sound area. Invasive plant species displace native plant and animal species and reduce species diversity. Unfortunately, eradication is not considered a viable management option. Therefore, the following recommendations were developed to address the issue.

1. Research needs to be conducted to increase information regarding these species. Even anecdotal information would be useful.

2. Case studies that clearly illustrate the issues need to be conducted and identified, and used to educate the public. Materials should be shared to eliminate redundant resource use.

3. The planting of invasive species should be prohibited. Government regulating agencies must prohibit the spread of invasive species and encourage the planting of native species. Permit requirements to combat invasive species should be streamlined or eliminated.

For more information, contact the Silvio O. Conte National Fish and Wildlife Refuge at 38 Avenue A, Turners Falls, MA 01376 or call 413-863-0209. Copies of fact sheets, lists and other documents about invasive species are available to the public.

6.53 Final Recovery Plan for the Shortnose Sturgeon

Shortnose sturgeon, (Acipenser brevirostrum), occur in estuaries and rivers along the east coast of North America. Severely impacted by over-fishing and poor water quality , the species has been listed as an endangered species since 1967. There are currently 19 distinct population segments of this species inhabiting 25 river systems in the United States. In 1998 the Shortnose Sturgeon Recovery Team released their plan for the recovery of the Shortnose sturgeon. The goal is to increase the population levels to the point where the Shortnose sturgeon is safely removed from the Endangered Species List throughout their existing ranges.

The Holyoke Dam divides the Connecticut River population into two distinct groups; the upriver group and the lower river group that reaches to Long Island Sound. Toxic contaminants, such as coal-tar leachate, which contaminates the sand where the fish larvae and embryos are placed, is believed to contribute to retarding reproduction. Hydroelectric dams, which prohibit fish passage to the headwaters of the river hinder recovery efforts, as does non-point source pollution flows into the river, which degrade water quality. Illegal poaching from the Connecticut River occurs, but is not considered to be a significant source of population loss.

Habitat restoration, including water quality and unimpeded fish passage, eliminating illegal takes by recreational and commercial fisheries, and mitigating and reducing human activities that impact the species, such as bridge construction, hydroelectric dam operations, and dredging, are the primary strategies advocated by the Plan. In addition, a Recovery Coordinator and Implementation Team, or several regionally-based teams should be created to implement the recovery plan.

6.54 A Management Plan for American Shad in the Connecticut River Basin

In 1992 a management plan was created to restore American shad to the Connecticut river basin. The Holyoke Dam impedes fish passage, despite the installation of a fish ladder and various other techniques in the 1970s. The goal of the Plan is to restore and maintain a spawning shad population to its traditional range in the

Connecticut River basin for recreational and commercial fishing purposes. Identified objectives include:

1. achieve annual passage of 40 to 60% of the spawning run;
2. achieve and maintain an adult population of 1.5 to 2 million entering the mouth of the Connecticut River annually;
3. enhance recreational opportunities throughout the American shad's traditional range.

6.55 Reach I (Turners Falls Pool) Bioengineering Program

This program is undertaken by a public and private partnership between the Franklin Regional Council of Governments, the Connecticut River Streambank Erosion Committee, and Northeast Utilities. The program addresses the issue of severe streambank erosion above the Turners Falls Dam that is threatening prime farmland, and other significant natural resources that abut the river. The United States Army Corps of Engineers conducted a study in 1991 to determine the expert of erosion in this reach of the Connecticut River. The findings indicate a threefold increase in soil erosion, with some shoreline areas having receded as much as fifty feet since 1979. *A Long Term Riverbank Management Plan* developed by Northeast Utilities provides an outline for future goals and implementation strategies. In addition, eight sites have been identified to test soil bioengineering techniques over a five-year period to reduce the erosion. It is estimated that Phase I of this project will be completed in the year 2000. Streambank stabilization efforts are expected to continue in the Turners Falls Pool at least until the end of the hydropower facilities' FERC licenses in 2018.

6.56 Urban Stream Assessment Project

The Urban Stream Assessment project, coordinated by Pioneer Valley Planning Commission and funded through a DEP 604(B) grant, analyzed two urban watersheds: Poor Brook in Springfield and Chicopee; and Tannery Brook in Holyoke. Geographic Information maps covering land use, soils, and hydrology were developed to assist with problem identification, watershed analysis and modeling. A matrix of potential instream and watershed management solutions was developed for each stream to reduce and prevent erosion, decrease stream turbidity, improve water quality, and improve wildlife habitat.

6.57 Western Massachusetts Streambank Protection Guide: A Handbook for Controlling Erosion in Western MA Streams. (January, 1998)

This publication was developed by the Franklin, Hampden, Hampshire Conservation Districts. The purpose of the manual is to provide basic information to local landowners and officials on how to identify streambank erosion problems, how to correct those problems, what types of solutions and alternatives are available, and then, how to manage the streambank after corrective actions have been taken. A short, user-friendly primer on streambank erosion control techniques entitled *Management of Streams in Western Massachusetts* is available from the Franklin, Hampden, Hampshire Conservation Districts.

6.6 PROGRAMS ON LAND USE AND GROWTH TRENDS

6.60 Valley Vision

Valley Vision, The Regional Land Use Plan for the Pioneer Valley, adopted by the Pioneer Valley Planing Commission in 1998, identifies threats to the Pioneer Valley section of the Connecticut River Valley, and identifies recommendations to mitigate these threats to the quality of life in the Valley.

The primary threat to land use and environmental quality in the Pioneer Valley include a dispersed, relatively low density development pattern referred to as sprawl. Sprawl growth patterns degrade environmental quality, contributing to degraded air quality from increasing commuter miles traveled, erodes the existing base of working and open landscapes by increasing development pressure, draws economic development opportunities away from the urban centers, encouraging urban decline. Valley Vision proposes a series of recommendations aimed at reducing sprawl, revitalizing urban areas, while preserving the rural character of the Valley. Key actions to be implemented include:

- completing comprehensive plans that are reflected and implemented by relevant and consistent local zoning bylaws;
- revitalizing urban centers;
- encouraging compact residential development, such as clustered development;
- revitalizing existing commercial and industrial centers, encouraging brownfields redevelopment and discouraging greenfields conversion;
- protecting and enhancing the environmental quality of life in the Valley by creating greenbelts, encouraging mass transportation to reduce auto emissions and improve air quality, and permanently protect prime agricultural areas as well as sensitive habitats;
- coordinating transportation on a regional basis to encourage public use and provide alternative forms of transportation, such as bikeways and pedestrian trails.

6.61 Franklin Regional Council of Governments Land Use and Growth Management Plan

In 1998, Franklin Regional Council of Governments developed a Land Use and Growth Management policy statement that developed a number of guidelines for managing growth including:

- development and redevelopment should be directed to existing village and town centers and local growth centers, identified by town Master Plans, which have the infrastructure and carrying capacity necessary to sustain the impacts of development;
- efforts should be made to create a regional Open Space Plan that would identify open space and habitat linkages between communities and provide a framework for preparing local Open Space Plans;
- greater emphasis should be placed on creating local Open Space Plans and providing resources to permanently protect open space through the acquisition of scenic easements or development rights.

6.62 Landowner Survey for the Connecticut River Valley of Massachusetts- National Park Service

In 1986 the National Park Service, in consultation with the Department of Environmental Management and the Connecticut River Watershed Council (CRWC) conducted a study to identify land ownership patterns within the nineteen Massachusetts communities that border the Connecticut River. The survey was designed to inform riverfront owners about the Connecticut River Action Program and the CRWC, and learn more about the landowners along the river. The survey results indicated that at that time, the majority of riverfront owners owned less than 5 acres of property and had between 100-500 feet of frontage. Half of the respondents indicated that they used their property for agriculture. Half of the respondents indicated that their property experienced flooding and while slightly less than half experienced erosion on their property. Recreation, public access and conflicting uses of the river were not perceived as being significant issues. The rate of farmland conversion to development and the loss of historical and cultural resources were not regarded with concern.

6.63 Zoning Review for the Connecticut River Valley of Massachusetts- National Park Service

This 1986 study was conducted to identify various resource needs, such as land conversion, and the appropriate local regulatory responses to resolve the issues. The report contains a review of the zoning and subdivision bylaws in nineteen communities that border the Connecticut River from Northfield along the Vermont border to Longmeadow and Agawam at the Connecticut border. In conclusion, the report also lists a series of alternatives to zoning to accomplish resource protection and enhancement goals.

6.7 PROGRAMS ON ECONOMIC DEVELOPMENT

6.70 The Pioneer Valley Plan for Progress; Economic Strategies for the Region

The *Plan for Progress* is an ongoing cooperative effort to ensure the economic vitality of the region while simultaneously conserving the environmental quality of the Valley. Initiated in 1994, the Plan identifies and articulates strategies designed to address the major issues confronting the region. Plan implementation will occur in stages; short-term strategies were instigated during 1995-1997; mid-term strategies from 1998-2000; and finally long-term strategies, which will carry the region into the next millennium.

Examples of identified strategies include:

- fostering small businesses and regional incubators throughout the region;
- capitalizing on the region's environmental aesthetic to promote recreational tourism, urban investment;
- continuing to operate in a regionally collaborative fashion to implement the *Plan for Progress*.

The Plan is currently under review, with a new updated Plan slated for release in fall of 1999. For more information, or to order a copy of the Plan for Progress, contact the Pioneer Valley Planning Commission at 413-781-6045.

6.71 Springfield Riverfront Revitalization Plan

This economic development initiative is a collaborative effort between the Plan for Progress Board of Trustees, the City of Springfield, and the Pioneer Valley Planning Commission to reconnect the urban core to the river. The Plan attempts to overcome infrastructure barriers, such as Interstate 91 and the Amtrak railroad line, that isolate the City from the River, discouraging public access and the economic benefits that could be realized. The City, a federally designated Enterprise Community, has been working for several years to assemble contiguous riverfront lands and develop public/private financial partnerships to recreate the riverfront as an economic focus point for urban redevelopment.

The Plan's implementation will include the expansion of the Basketball Hall of Fame and construction of a commercial complex, redevelopment of the historic

Springfield Armory and York Street Jail, a new state Tourist Information and Convention Center complex, and the Connecticut RiverWalk and Bikeway trail system to provide public access to the various attractions and recreational opportunities.

For more information on the Riverfront Revitalization efforts, contact the Springfield Department of Economic Development at 413-747-5190.

6.72 Connecticut Riverwalk and Bikeway

The proposed project will connect the communities of Springfield, Chicopee, Agawam, West Springfield, and Longmeadow with a pedestrian and bicycle pathway on the banks of the Connecticut River. The Riverwalk is one of the recommendations delineated in the *Connecticut River 2020 Strategy.* It is anticipated to stimulate economic development opportunities along the riverfront in the urban areas, will provide public access and enhance recreational opportunities near and on the river, and will serve as the initial component of a greenbelt along the Connecticut River. Project proponents include the Pioneer Valley Planning Commission, Agawam, Chicopee, West Springfield, Springfield, and Longmeadow.

6.73 Tri-County Connecticut River Scenic Farm Byway (See summary on page 67).

6.74 Connecticut River Valley; Special Resource Reconnaissance Study-National Park Service

This study, conducted by the National Parks Service and published in 1998, analyzes the potential for establishing a new National Parks unit in the Connecticut River Valley that would collaborate with the United States Fish and Wildlife Service Conte Wildlife Refuge in Turners Falls. The study found that although it may be possible to designate the Connecticut as a National Heritage Area or Corridor, it would not be feasible to establish a new NPS unit in the region due primarily to the dispersion of resources throughout the Valley, the fragmented and diverse land ownership pattern and the number of political jurisdictions contained within the Valley.

A National Park Service Heritage Corridor would focus on the history of the region as the "Precision Valley", which received this designation in part because of the federal armory established in Springfield in 1794. The Springfield Armory spurred industrial development along the river, with factories producing a wide variety of manufactured goods from guns to cutlery and sewing machines. National Heritage Areas and National Heritage Corridors are designated by Congress and created through enabling legislation. The NPS study indicates that further research is needed and equally significant, the generation of public support is necessary for the designation of a Precision Manufacturing Corridor to be seriously considered. Further recommendations from the report suggest implementing any National Corridor designation on an incremental town-by-town basis between Windsor, Vermont and New Haven, Connecticut.

The NPS considered three alternatives in the report; designating portions of the Connecticut River Valley as "Precision Valley"; designating all or a portion of the Connecticut Valley as a National Heritage Area; and encouraging inter-agency cooperation without designating the Valley as a National Heritage Corridor or Area. The NPS identified several significant obstacles to either a Corridor or Area designation; namely the size of the Connecticut River Valley, the lack of a management entity in place, the diversity of the Valley and the lack of one unifying theme that could tie the Valley together. However, the NPS clearly indicates that the most critical characteristic necessary to accomplish this designation is strong public demand. At the present time, the public support necessary to encourage Congress to pass enabling legislation to achieve the designation does not exist. The NPS suggests that until a groundswell of public support emerges, the pursuit of National Heritage Corridor or National Heritage Area designation is premature.

Regardless, the NPS will continue to be involved in the Massachusetts reach of the Valley through the Springfield Armory National Historic Site and the Great Falls Discovery Center Partnership. It was recommended in this report that the NPS and the Fish and Wildlife Service (through the Conte Wildlife Refuge) form a Memorandum of Understanding (MOU) to coordinate Department of the Interior activities throughout the Connecticut River Valley, and expand the resources available to further cultural resource appreciation throughout the Valley. Obstacles identified include the groundswell of public support needed to overcome the difficulties of designating the CT River Valley as a National Heritage area or a National Heritage Area and lack of funding for the NPS to greatly enhance its presence in the area.

6.8 PROGRAMS ON PUBLIC ACCESS AND RECREATION

6.80 Connecticut River 2020 Strategy, Part 2: Action Strategy for Riverfront Revitalization

Prepared by the Pioneer Valley Planning Commission in 1995, the Connecticut River 2020 strategy for riverfront revitalization is presented in terms of overarching

regional strategies and action plans specifically designed for the seven Connecticut riverfront communities of Agawam, Chicopee, Holyoke, South Hadley, Springfield and West Springfield. Recommendations to achieve riverfront revitalization in the urban reach of the Connecticut River include: increasing regional cooperation between municipalities and other interest groups, improving the quality of the resource to swimmable standards, restoring and protecting fish and wildlife habitats, educating area residents about the river's natural and cultural heritage and developing public/private partnerships to implement strategies. Specific action strategies include:

- design and construct a Riverwalk and Bikeway connecting the riverfront communities of Springfield, Chicopee, West Springfield, Agawam and Longmeadow;
- empower the Connecticut River Clean-Up Committee with funding to begin addressing the well-documented problems resulting from the continued presence of Combined Sewer Over flows (CSOs) in the reach of the Connecticut River below the Holyoke/South Hadley Dam;
- pursue designation by the National Parks Service (NPS) of a Connecticut River Natural Heritage Area, that would link together the historical and cultural resources of the Connecticut River Valley, and provide interpretative educational opportunities for area residents as well as tourists;
- support the United States Fish and Wildlife Service, Conte Wildlife Refuge and the goal to acquire or permanently preserve land with significant wildlife habitat throughout the region;
- develop a channel-marking and water use zoning program for the lower reach of the Connecticut River to facilitate safe recreational opportunities on the water.

Individual community revitalization plans focus on existing resources and enhancement opportunities.

6.9 PROGRAMS ON OUTREACH AND EDUCATION

6.90 Great Falls Discovery Center Partnership

A partnership between public and private stakeholders is focused on the economic revitalization of the Turners Falls economy. The partners include: the Montague Economic Development and Industry Council, Northeast Utilities, the Connecticut River Watershed Council and the MA Audubon Society, the U.S. Fish and Wildlife Service Conte Refuge, the MA Departments of Fisheries, Wildlife and Environmental Law Enforcement (DFWELE) and the Department of Environmental Management (DEM). The Great Falls Discovery Center will become a visitors information and interpretive center for the Connecticut, providing exhibits, publications, productions and workshops that will teach visitors about the history, culture, and environment of the Connecticut River.

The Discovery Center has received $500,000 from the Commonwealth of Massachusetts, and $850,000 from The United States Fish & Wildlife Service (USFWS) to fund this project for the first five years. In addition, the other partners are committing resources to the facility to ensure long-term success and continuity.

6.91 CRWC Website and Newsletter

The Connecticut River Watershed Council (CRWC) has a website (www.ctriver.org) that could be used as a central point of contact regarding watershed activities. For those watershed residents who do not have access to the World Wide Web, there is a newsletter distributed on a varying basis, depending upon what relevant information CRWC has to share with their members. CRWC is a non-profit organization that is dependent upon member contributions and volunteers.

7.0

SUMMARY OF VOLUME II OF CONNECTICUT RIVER STRATEGIC PLAN

7.1 PROJECTS

Volume II of the Connecticut River Strategic Plan contains the final reports for seven distinct watershed projects, completed by Watershed Team members, and funded under the EOEA Watershed Initiative Comprehensive Grant. A brief description of the project reports is provided in this section. For specific details please refer to the individual reports in Volume II, which is available by request from PVPC.

7.2 CREATION OF A LITERATURE DATABASE AND INTERNET WEBSITE

Connecticut River Watershed Council (CRWC) prepared a master list of relevant organizations was compiled for the watershed. A survey was then sent to each group requesting information about organizational goals, typical responsibilities and activities, workshops and publications, membership and staffing levels, and other relevant information. The resulting document is entitled "Connecticut River Environment"

7.3 PUBLIC OUTREACH, COMMUNICATION, AND GRASSROOTS INVOLVEMENT IN THE WATERSHED PLAN.

In coordinating the education and outreach component of the program, CRWC devised an outreach work plan that sought to gather input from citizen's about managing the watershed and to guide the development of the Strategic Plan that can be implemented by organizations, communities, businesses, and individuals. The outreach plan included:

- Establishing a Civic Leader Network of town leaders, planning board and conservation commission members, stream team participants, sub-watershed associations, and business leaders. This network will serve as the core of an interactive partnership to undertake watershed management at the local level.
- An Internet site and a newsletter were created to serve as communications mechanism for interaction with the civic network.
- The Civic Leader Network was surveyed about technical assistance needs, community methods for addressing nonpoint source pollution, priority water quality problem areas, and awareness of state and regional watershed management programs. The results of the survey were analyzed and compiled into a final document.
- Workshops were organized to give network members the opportunity to learn about environmental issues and programs.
- A small grants database was developed describing existing Federal and State grant programs related to watershed management. The description of funding sources included eligible applicants, program requirements, and contact information.

7.4 WATER QUALITY ASSESSMENT AND SAMPLING

This task was completed by the Massachusetts Water Resource Research Center (MAWRRC), and included design and implementation of a watershed-wide monitoring program. The Water Resource Research Center reviewed water quality data currently available for the main stem of the Connecticut River in Massachusetts and the lower reaches of its major tributaries, in order to guide future monitoring. The water quality data was obtained from reports published within the past ten years by federal, state, and local agencies as well as by local citizen volunteer organizations.
A sampling effort known as the "Swimming Hole Project" was conducted. Sampling sites were selected on the Connecticut River that sustain a high level of recreational use. The sampling program focused on fecal coliform bacteria due to its potential impact on human health and recreation. Elements of the program in-

cluded the use of trained volunteer monitors, free analysis by community waste water treatment plant laboratories, and an extensive reporting of results to the public through newspaper articles and posting of signs at sampling sites.

7.5 ASSESSING WATER QUALITY AND THREATS TO WATER RESOURCES IN THE MILL RIVER (HATFIELD) WATERSHED

The focus of this project is the Mill River that drains parts of Conway, Deerfield, Whately, Hatfield, and Northampton on the west side of the Connecticut River. The Mill River Watershed Project used a broad partnership involving primarily UMASS Extension, Smith College, Franklin Regional Council of Governments, the Natural Resources Conservation Service (USDA), and Silvio 0. Conte National Fish & Wildlife Refuge.

The goal of the project was to make science, research, and planning resources available to local officials and their communities to help them develop and carry out effective watershed protection measures. Project partners worked together to:

- Assess water quality and habitat conditions in the river and its tributaries;
- Identify opportunities to protect farmland and forest health, and to enhance wildlife habitat and recreational values;
- Provide local officials with sound scientific information to back up their decisions about how to protect watershed resources;
- Offer young people an opportunity to learn about the environment and to develop a sense of responsibility for their communities.
- Develop a coordinated approach to resource protection across town boundaries, including formation of a Mill River Watershed Council. The council will develop a long-term plan based on the information brought by this project.

7.6 MILL RIVER OPEN SPACE MAPPING AND ANALYSIS

The Pioneer Valley Planning Commission completed the Mill River (Hadley) Open Space Mapping and Analysis project. The purpose was to develop a method of prioritizing parcels within the Mill River watershed for open space protection as a demonstration of planning that could be used in the larger Connecticut River watershed. The selection of parcels for open space protection were guided by the goals of the project, which are to provide long-term protection of the water quality and wildlife habitat within the Mill River watershed.

7.7 URBAN STREAM ASSESSMENT PROJECT

This project was completed by Pioneer Valley Planning Commission and involved a heavily urbanized stream, Tannery Brook in Holyoke. The project goal was to identify ways to restore water quality by enhancing the natural functions of the stream. The project sought to find solutions to identified stream problems by gathering information on the existing conditions of the watersheds, including modeling of stream flows, in order to address stormwater runoff, erosion and sedimentation, wetlands degradation, and flooding.

7.8 WETLANDS FUNCTIONAL DEFICIT ANALYSIS OF THE MILL RIVER WATERSHED

This project was completed by the Franklin County Regional Council of Governments and involved the an analysis of wetlands in the Mill River Watershed of Hatfield, Conway, Deerfield, Whately, Northampton and Williamsburg. FRCOG mapped and classified wetlands, and assessed wetland functions, leading to conclusions and recommendations. Recommendations included reduction in road runoff and other non-point pollution, restoration of woody riparian stream buffers, eradication of non-native invasive species, removal of direct livestock access to the Mill River and restoration of wetlands.